Subsistence Benefits from the Babassu Palm (*Orbignya martiana*)[1]

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*Stands of babassu palms (*Orbignya martiana*) occupy an area of Brazil estimated at nearly 200,000 km², concentrated in the states of Maranhão, Piauí and Goiás. Babassu's cryptogeal germination, establishing the apical meristem of the plant below ground for its early growth and development, enables it to survive human disturbance, making the palm an integral part of shifting cultivation and pastoral farming systems. People obtain a multitude of products from babassu throughout the palm's life cycle: leaves are used widely for thatch, basketry, and construction; trunks for palmito and bridges; the fruit for feed, oil and, charcoal. As many as 450,000 subsistence-level households rely on the sale of babassu kernels, used in a regional vegetable oil industry, for an important share of their cash incomes. Deforestation pressures and technological innovation toward an industry based on mechanical processing of whole babassu fruit threaten to reduce benefits the palm provides to the region's rural poor. Understanding how babassu is used by rural families who depend upon it will help to make current efforts at "domesticating" the palm and whole-fruit processing more responsive to human needs.*

The *babassu* palm (*Orbignya martiana* Barb. Rodr.), spelled *babaçu* in modern Portuguese, reaches a height of up to 30 m at maturity; its dense crown of arching pinnate leaves has a diameter of 8 m. Babassu palms form monospecific stands over wide areas of Brazil (Fig. 1) on sites where there has been disturbance of the original vegetation, for example, where primary forests have been cleared. Babassu stands are concentrated in the southern portion of the Amazon Basin, an area that has undergone rapid population growth in recent decades as waves of settlers have arrived from other regions of Brazil. Today the palm forests represent a crucial source of subsistence goods and services for hundreds of thousands of rural families.

This article examines the role of babassu in the lives of people who rely on the palm for an important share of their livelihood. Most of the literature (e.g., Teixeira Leite, 1953; MIC/STI, 1977) focuses on the palm's potential as a source of raw materials for industrialization, largely ignoring its importance in subsistence economies. Current efforts aimed at expanding the market potential of babassu products and clearcutting of the palm forests for more intensive agriculture often conflict with the basic needs of people dependent on the palm. A knowledge of these needs may point the way toward more harmonious utilization of babassu in both market and subsistence economies.

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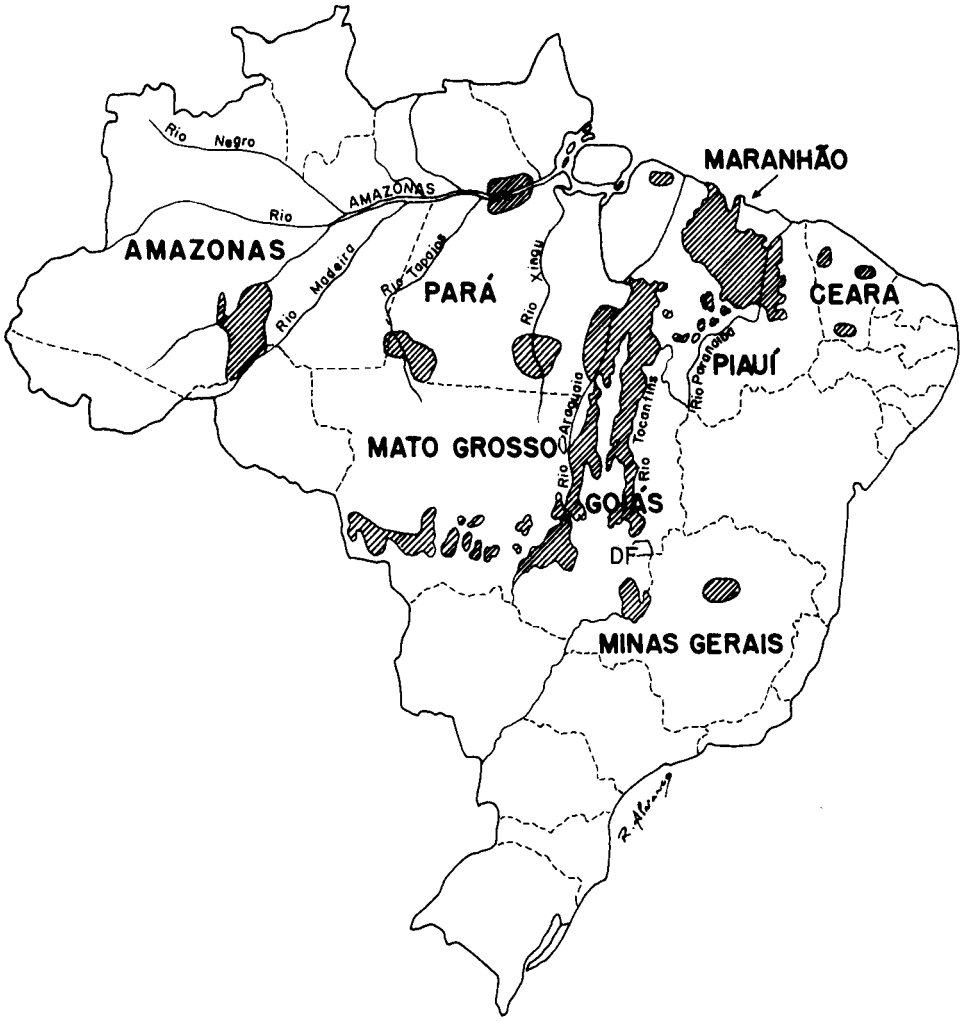

Fig. 1. Distribution of babassu stands in Brazil. States containing stands are labelled. Adapted from MIC/STI (1982) (drawn by R. Alvares).

THE REGION AND ITS PEOPLE

Although babassu and closely related species of *Orbignya* occur widely in tropical Latin America, the palm attains its greatest coverage and economic importance in a climatic transition zone between the humid Amazon Basin and the drier regions of central and northeast Brazil. This zone includes portions of the Brazilian states of Maranhão, Piauí, and Goiás (Fig. 1); estimates of babassu occurrence in Brazil and the importance of these 3 states in the production of kernels are shown in Table 1. The palm forests in this transition zone tend to be associated with moderately drained, alluvial soils. However, babassu occurs over an extremely wide range of edaphic and climatic conditions in the American tropics. Its apparent adaptability, capacity to form high-density stands, and economic importance suggest that babassu may be an appropriate perennial species

TABLE 1. AREA OF BABASSU STANDS AND THEIR COMMERCIAL EXPLOITATION IN THE BRAZILIAN STATES OF MARANHÃO, PIAUÍ, AND GOIÁS.

State	Area of stand occurrence[a]		Kernels marketed[b] (1980)	
	km²	%	Metric tons	%
Maranhão	103,040	53	183,455	73
Piauí	19,780	10	20,214	8
Goiás	29,710	15	43,451	17
Other states	43,840	22	3,831	2
Brazil	196,370	100	250,951	100

[a] MIC/STI (1982), and estimates of coverage in other states.
[b] IBGE (1983).

for rehabilitation of degraded sites over widespread areas of the humid and seasonally humid tropics (Anderson and Anderson, 1983).

Prior to the arrival of Europeans, the babassu zone had long been occupied by numerous indigenous groups. Among the dominant sedentary tribes (Steward, 1963), agriculture was generally confined to the moist bottomlands, and villages were established nearby. During the drier months, bottomland stands of babassu and *buriti* (*Mauritia flexuosa* L.) palms provided an important dietary supplement. Territorial rights were identified with access to the stands, which served as a source of food, fiber, and possibly fuel. High-density stands of babassu were probably limited to these bottomland sites. The original nature of the far more extensive upland forests can be discerned in the remnants that still exist: babassu was commonly present but invariably associated with numerous hardwood species.

With the arrival of Europeans during the 1600s, landscapes throughout this zone gradually changed. In response to the needs of the colonial economy, plantations of sugarcane and cotton were established on bottomland areas. Yet more than 2 centuries elapsed before the first historical reference was made to babassu stands in this zone (Prazeres, 1820, cited in Abreu, 1940: 11), which suggsts that the palm forests were not as extensive as they are today. As soil fertility declined and weeds became a serious problem, cultivated lands were abandoned (Andrade, 1979), and these sites were recolonized by high-density stands of babassu. With the abolition of slavery in 1888, the plantation economy collapsed. Like the Indians before them, the freed slaves and their descendants were dependent on palms for food, fuel, and fiber. As population increased, agriculture in the form of shifting cultivation moved out of the bottomlands into the mixed upland forests, and stands of babassu gradually spread across the landscape. The size of these stands today is dramatic testimony to the sweeping impact of human occupation in this zone.

Babassu's dominance of the landscape results from its extraordinary capacity to survive human-induced stresses, such as cutting and burning. The key to this capacity is a curious adaptation known as cryptogeal (or "hidden") germination. Upon germination, the apical meristem, or growing point, is pushed into the ground, where it remains until vertical growth commences several years later. As the apical meristem is protected underground, cutting and burning do not kill stemless palms. Thus when primary forests containing babassu are cut and burned, stemless palms survive, often in high densities, even though mature palms may

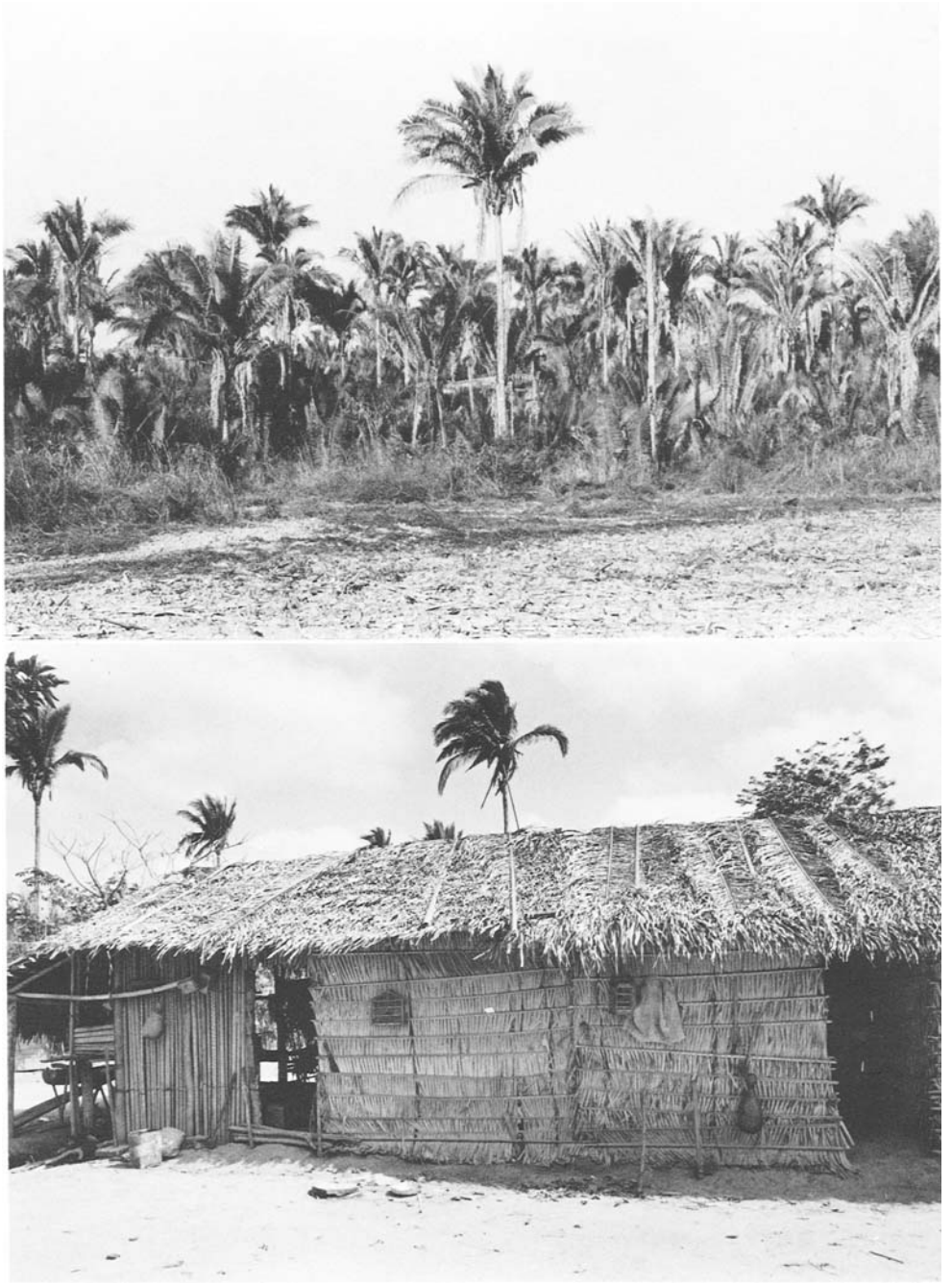

Fig. 2-3. Fig. 2. Babassu stand in Maranhão, Brazil (photo M. J. Balick). Fig. 3. House with thatch and walls of babassu leaves; birdcages are made from leaf rachis (photo M. J. Balick).

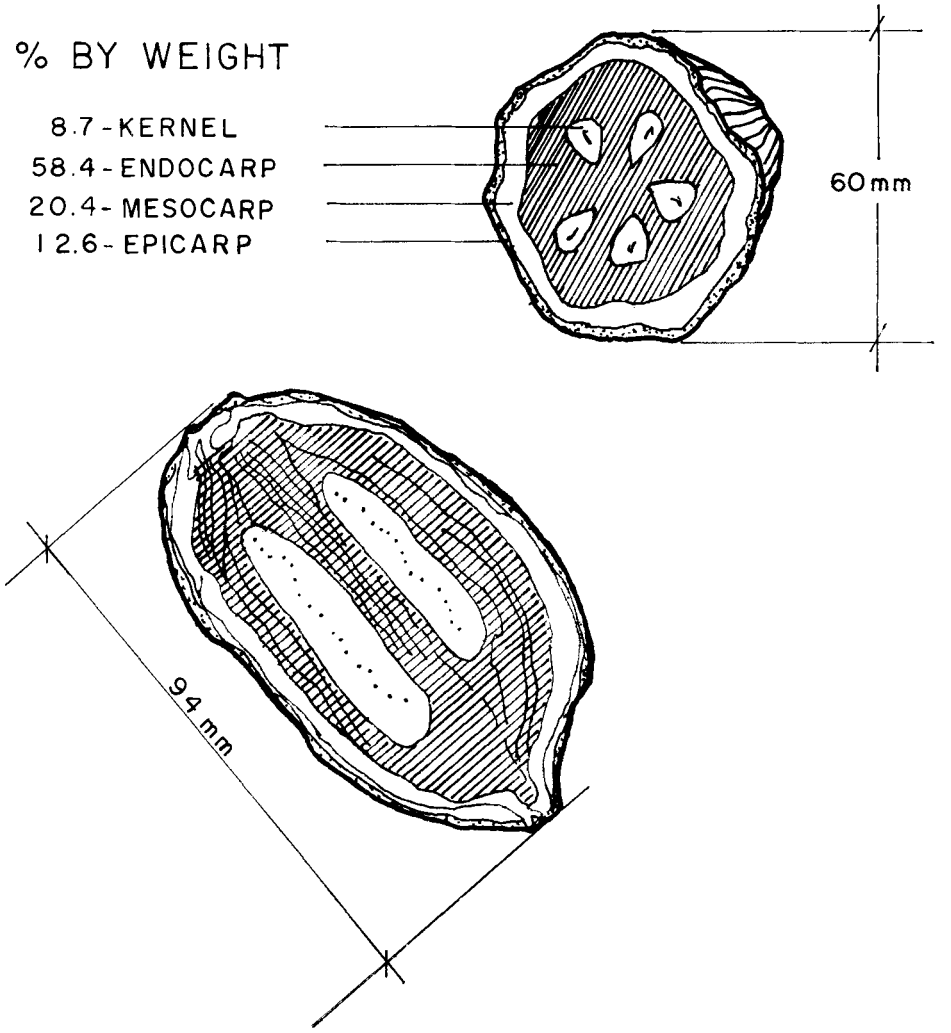

Fig. 4. Average composition and size of babassu fruits. Numbers do not add to 100% due to rounding. Data obtained from 6 different populations in Pará, Goiás, Maranhão, Piauí, and Ceará (Balick and Frazão, unpubl.) (drawn by R. M. Lima, after Governo do Estado do Maranhão, 1978: 31).

succumb. Released from competition, they form monospecific stands of babassu (Fig. 2).

Although the palm is rarely planted today, its current distribution may be partially due to transplanting by indigenous peoples. Long-distance dispersal seems to have been aided principally by runoff from rivers in flood, which could have transported fruits from babassu's presumed center of distribution in the state of Goiás (Markley, 1971). Isolated stands of the palm in the states of Ceará and southern Pará, however, may have been planted by humans. Recent research with the Kayapó Indians reveals that tribal groups manage the regrowth of secondary forests in areas cleared for agriculture, purposefully planting groves of babassu

Fig. 5–7. Fig. 5. Weaving a basket of babassu leaves on a mat woven of the same material (photo A. Anderson). Fig. 6. Woman breaking babassu fruits (photo M. J. Balick). Fig. 7. Pile of babassu husks for conversion into charcoal (photo M. J. Balick).

and other long-lived trees (Posey, 1984). The palm continues to have an important role among Indian groups scattered throughout the region.

The majority of the residents of the babassu zone today are farmers, descendants of colonial settlers who intermarried with Indians and Negro slaves. For the most part, they are landless squatters or renters of land on large estates, paying in specie for the right to plant their crops (particularly rice, corn, beans, and manioc) and to collect babassu fruits, which they are obliged to market through the landlord or his agent. Agriculture in this zone generally consists of shifting cultivation, in which sites are periodically cleared, burned, cultivated, and subsequently fallowed for 3–8 yr before being used again. In dense babassu stands, shifting cultivators generally thin rather than clearcut the mature palms, thus permitting sufficient light for cultivation of crops while assuring the production of forest resources (in the form of babassu leaves and fruits) during the subsequent fallow. In the wetter portions of the babassu zone (central Maranhão and northern Goiás), conversion of formerly cultivated sites to improved pastures is occurring at an accelerating rate. The tenacity of babassu on these sites interferes with the maintenance of a permanent grass cover. Ranchers are compelled to control the palm by repeated cutting and burning, selective application of herbicides, or, in some cases, by clearcutting the stands and grading the topsoil. Mature palms, however, are generally retained at moderate densities, providing an additional source of income for the landowner and his tenants.

USES OF BABASSU THROUGH ITS LIFE CYCLE

One of the most remarkable features of babassu is its large fruits, which range in fresh weight from less than 100 to over 450 g, with an average of 190 g (Balick and Frazão, unpubl. data; Fig. 4). On a local scale, these fruits are generally dispersed by runoff on open sites and by rodents such as pacas (*Agouti paca*) and agoutis (*Dasyprocta punctata*) on forested sites. These rodents, which feed on the

TABLE 2. PROPORTION OF RURAL FAMILIES USING BABASSU PRODUCTS IN 4 MARANHÃO MUNICÍPIOS.

Município	Percent of families interviewed					
	Thatch	Basketry	Charcoal	Milk	Oil	Palmito
Bacabal[a] (n = 104)	86	96	96	44	53	n.a.
Lima Campos[b] (n = 64)	94	83	92	70	66	8
São Bento[b] (n = 57)	76	72	49	72	74	16
Chapadinha[b] (n = 98)	86	90	96	89	91	42
Average	86	85	83	69	71	22

n = Sample size.

[a] Source: Anderson and Anderson (1983).

[b] Source: May, unpubl. data.

starchy fruit mesocarp, abound in babassu stands and provide an important source of game meat for rural families (Smith, 1974). Removal of the mesocarp by rodents acts to stimulate germination in babassu, which under normal conditions requires about 3 mo (Anderson, 1983). Initial growth is extremely slow. On a primary forest site, a seedling of babassu required an average of 7 yr to produce its first divided leaf and another 42 yr to initiate vertical growth of the stem (Anderson, 1983). (Small farmers tell us, however, that under more propitious growing conditions, babassu begins to bear fruit 10–20 yr after seedling emergence.) Palms that have passed the seedling stage and have not yet begun vertical stem growth are referred to as *pindovas*. Extremely high densities of pindovas occur on sites where babassu predominates. Their leaves provide a source of animal feed in times of poor pasture growth, particularly for horses and donkeys, but also for cattle when there is no other option. Leaves from these palms are cut, collected in bundles, and fed to animals.

Leaves are harvested not only from pindovas but from palms in subsequent stages as well. Care is taken to cut leaves only during the waxing of the moon, a practice that is believed to improve the resistance of the leaves to infestation or deterioration. Leaf harvesting does not appear to impede growth of the palm or production of fruits permanently, as long as it is carried out at sufficiently wide intervals; a defoliated palm recovers its full crown in 3–4 yr. Most landowners permit leaves to be cut every other year, with the proviso that the newer leaves are retained to assist in the palm's subsequent recovery. For production of baskets or mats (Fig. 5), however, people harvest younger and more flexible leaves, which would certainly seem injurious to the vigor and productivity of the tree.

Rural families cut leaves (which may total over 25 per mature palm) for construction or reinforcement of their dwellings (Fig. 3), and for building fences, frames for vegetable planters, and other items. Babassu thatch is by far the most frequently used roofing material in the region (Table 2). Rural people are adept at weaving leaflets and often carry out this task at dusk, when it is too dark to pursue other economic activities. Fibers from the rachis are used to make bird cages and provide twine. Among the Apinajé Indians in northern Goiás, leaves of babassu are also used to make animal traps. Fences made from leaf rachises demarcate traditional hunting zones. Finally, the Indians use a liquid they extract from the leaf rachis as a medicine to cleanse wounds and stop bleeding. Subsistence uses of babassu leaves are summarized in Table 3.

TABLE 3. SUBSISTENCE USES OF BABASSU LEAVES.

Fibers	
Baskets	storage and transport
Mats	doors, windows, rugs, grain-drying
Fans	ventilating fires
Sieves	sifting manioc flour and rice
Others	twine, torches, whisks, bird cages, hunting blinds, animal traps
Construction materials	
Thatch	roofing and walls
Laths	support for clay-packed walls
	frames for windows
Rails	fencing to protect agricultural plots from animals and delimit hunting zones
Agricultural uses	
Leaves burned in shifting cultivation plots to promote nutrient recycyling and pest control	
Rachis used for crop stakes and building raised planters	
Living leaves in pastures provide shade for livestock and feed during dry periods	
Medicine	
Liquid expressed from rachis used as antiseptic and styptic	

A palm that survives to stem emergence is called a *palmiteiro*. People sometimes kill these palms for extraction of the palm heart (*palmito*), which is used as food for domesticated animals and people, as well as a maturing agent for bananas. Palmito is cut into small pieces, on which unripe bananas are placed overnight; maturing is speeded by this process, probably due to a gas released from the palmito on exposure to air. The practice of cutting babassu for palmito is limited to some extent by state laws and local taboos that prohibit the cutting of palms. Despite this protection, palmiteiros are subject to high mortality on sites where cutting and burning are frequent, due to increased susceptibility of the emerging apical meristem to damage. As a result, the density of palms that survive to subsequent stages tends to be comparatively reduced.

After stem emergence and prior to initiation of flowering, the palm is called a *capoteiro* or *garrote*. Flowering usually begins when the palm attains a height of 4–8 m. In a given stand, roughly 40% of the mature palms produce exclusively staminate inflorescences; such palms are termed "male" (*macho*). Ranchers and shifting cultivators alike thin preferentially palms with low fruit yields. In some areas, the stems and detritus from such thinnings are piled in windrows and subsequently provide a fertile substrate for plantings of corn. Babassu stems are used for building bridges and foundations (Table 4). People often hollow out the stump after cutting; the sap that collects in the depression ferments, producing an alcoholic beverage known as palm wine. The stem is sometimes left in situ to attract beetle larvae (*Rhynchophora palmarum*), which are subsequently gathered and cooked. These and other beetle larvae provide protein and are a common food in the Amazon Basin.

The Kayapó Indians in southern Amazonia make salt from stems of babassu and other Amazonian palms. Old, dry stems are left to burn slowly overnight. On the following day, the Indians collect the ash in baskets made from palm

TABLE 4. SUBSISTENCE USES OF BABASSU STEMS.

Construction
Bridges
Foundations
Benches
Palm heart
Food for people
Feed for animals
Ripening agent for banana
Sap (collected from stump of felled palms)
Fermented drink
Attraction of beetle larvae that are eaten or used as fish bait
Mulch/planting medium (obtained from decayed stems)
Salt (made from ash of burned stems)

leaves, through which water is subsequently filtered, collected in a gourd, and allowed to evaporate, leaving a salty residue. This process provides the Kayapó with their principal source of salt, which is used in cooking and medicine.

When unproductive palms are felled as part of agricultural practices, farmers spread the leaves to dry on the field along with those cut from standing palms to promote rapid ignition of slashed vegetation. An intense fire converts a maximum amount of this material to fertile ash and controls pests such as weeds and herbivores. In pastures, landowners generally retain moderate densities of adult palms to provide shade for cattle, promote moisture retention, and generate organic matter.

Palms that were formerly productive but no longer bear fruit are known as *coringas*. When these palms finally fall, rural families use their decomposed stems as a mulch and planting medium for vegetable gardens and raised planters. Potting soil of decayed babassu palm stems is also sold in urban areas.

THE "MIRACULOUS" BABASSU FRUIT

The fruit of the babassu palm is of great importance to the region's economy. In addition to income derived from the sale of kernels or entire fruits to regional industries, babassu fruits are an important source of food and fuel for rural families. According to one estimate (Mattar, 1979), at least 450,000 families throughout Brazil collect and break babassu fruits for extraction and sale of kernels. This figure probably underestimates the total number of families dependent on babassu fruits as a source of livelihood; recent surveys in Maranhão reveal that a small percentage (8%) of rural families use babassu fruits domestically but never sell the kernels (May, unpublished data).

Mature fruits begin to fall from their bunches between August and October, and continue to drop until the beginning of the rainy season in January and February, although there appears to be some year-round maturation in babassu. Fruits remaining on the ground are attacked by bruchid beetles (*Pachymerus nuclearum*), which enter the fruit and feed on the kernels; after 3 mo about 70%

TABLE 5. SHARE OF HOUSEHOLD INCOME DERIVED FROM BABASSU PRODUCTS IN 3 MARANHÃO MUNICÍPIOS (OCT–DEC 1983).[a]

Município	Proportion of total income (%)				Weekly per-capita income (US$)	
	Babassu		Nonbabassu			
	Cash	Noncash	Cash	Noncash	Babassu	Total
Lima Campos (n = 26)	25.9	12.4	33.7	28.0	$1.56	$4.08
São Bento (n = 26)	10.4	1.8	53.4	34.3	$0.18	$1.50
Chapadinha (n = 22)	40.3	8.4	37.7	13.5	$0.70	$1.43
Average	25.5	9.3	38.8	26.4	$0.81	$2.34

[a] Data represent weekly budgets of 74 households in selected villages; n = number of households sampled. Calculated values for noncash income were obtained by asking respondents what the cash value of subsistence products would have been if purchased in local markets. Source: May, unpubl. data.

of the fruits have at least one kernel destroyed by larvae (Anderson, 1983). Known as *gongo,* these larvae are extracted during fruit breaking and are used either as fish bait or fried and consumed by people. When fried, these larvae have a flavor resembling that of bacon.

The harvesting of babassu fruits complements other economic activities carried out by rural households. During the peak of the harvest in the latter part of the dry season (September–December), agricultural activities are limited to the preparation of land for subsequent planting; these activities are generally carried out exclusively by men. Consequently, the task of breaking babassu fruits is usually confined to women and children. During the subsequent rainy season, the family breaks fruits that have been stored.

Babassu kernels are contained within a fruit wall (endocarp) averaging 5 cm in diameter (Fig. 4). To extract the kernels, the fruit is placed on the edge of an upright hatchet blade and struck repeatedly with a wooden club until it splits (Fig. 6). The broken portions are each in turn hit against the blade to dislodge the kernels. A skilled fruit breaker extracts most of the kernels entire. Although potentially dangerous, few injuries are reported from breaking babassu fruits. As this activity commences as soon as a child is strong enough to manage it (generally at 6–7 yr of age), fruit breakers attain a high degree of skill. Although most people extract from 3–5 kg of kernels per day, some occasionally produce up to 10 kg. During the peak of the harvest, people select fruits that contain the greatest number of kernels. A fruit's size and shape provide knowledgeable people with an indication of its kernel content. Whereas the average number of kernels per fruit is 3.1 (Anderson, 1983), the range is 0–11 (May and Anderson, unpubl. data).

Although breaking of babassu fruits is generally carried out by women and children, men are active in transporting fruits to the home for breaking at a later time. In 3 *municípios* (the Brazilian equivalent of an American county) in the state of Maranhão, some women (24%) broke fruits exclusively in the palm forest, but the majority (64%) preferred to carry out this activity at home (May, unpubl. data). The proportion of cash income derived from the sale of babassu kernels is considerable. Table 5 shows the share of total cash revenues obtained from babassu during the peak of the fruit harvest (October–December 1983) in the 3 municípios. This share is highest among the poorest households, which have few options other than breaking babassu fruits to furnish cash requirements, especially due to the

scarcity of agricultural produce stored from the poor harvests of the previous year. Without income from the sale of babassu kernels, these families would probably be unable to finance the current year's planting.

Whereas most extracted kernels are sold immediately, a small proportion—averaging 6.2% of total kernels extracted by sampled households in 3 Maranhão municípios, or about 0.7 kg weekly per household during the peak of the harvest—is used domestically. These figures exclude consumption of kernels as a snack, which could not be accurately measured. Consequently, both domestic use and total production of babassu kernels are underestimated. People sometimes remove unripe fruits from the bunch to extract the watery endosperm (*água de côco*), which is consumed as a beverage or used as a remedy for sties and hemorrhaging. Ripe kernels are pounded in a mortar until well crushed, mixed with water, and filtered to produce babassu milk. This milk is used primarily in stewing fish, game, fowl, and goat meat. Alternatively, people consume the milk directly or mixed with coffee. Milk made from ripe kernels is rarely fed to infants, as its high fat content makes it difficult to digest. The less fatty milk from immature kernels is sometimes made into porridge as a food for infants. This milk's unbalanced amino acid composition (Fig. 8) and relatively low mineral content make it unsuitable as a substitute for mother's milk; however, kernel milk and residues could serve as important dietary supplements for rural families and farm animals (Governo do Estado do Maranhão, 1973).

Kernels are also used domestically to produce oil for cooking, soapmaking, and burning in lamps. To make oil, people roast the kernels lightly and then mash them in a mortar. Water is then added and the mixture is cooked to release the oil, which is skimmed off the surface. For soap manufacture, the oil is mixed with caustic soda and rice flour, cooked, and subsequently poured into molds. Pigs and fowl feed on the residues, which are high in protein. These residues are also frequently roasted and used as a coffee substitute, or mixed with coffee to extend the family's supply in lean times. In coastal and estuarine areas, fishermen moisten the dried residues of babassu kernels to make a cake, which is wrapped in leaves and placed inside shrimp traps; they claim that the strong odor given off by the kernels serves as a most effective bait.

The woody endocarp that encloses the kernels also has an important role in subsistence economies as a source of fuel. Most households produce charcoal from these husks on a weekly or biweekly basis. After breaking fruits, people leave the husks in piles for drying and subsequent carbonization. Kindling is initially ignited in a round hole (*caeira*), approximately 1 m in diameter and depth (Fig. 7), into which the husks are gradually pushed. Once all the husks are well burned (usually no more than 1 h after ignition), water is sprinkled over them to slow combustion, and the caeira is covered with palm leaves and sand. After allowing carbonization to continue overnight, people remove the charcoal and store it in baskets made from babassu leaves. Reduction in husk weight is 75%. Households use an average of 25 kg of this charcoal each week for cooking.

Babassu charcoal is the most frequently used cooking fuel encountered among families interviewed in the state of Maranhão, although in some areas fuelwood is preferred (Table 2). The charcoal produces a smokeless, long-lasting fire that is appropriate for local, clay-covered stoves. Babassu charcoal is increasingly sold to national and foreign buyers for use as fuel in a variety of industries; its low

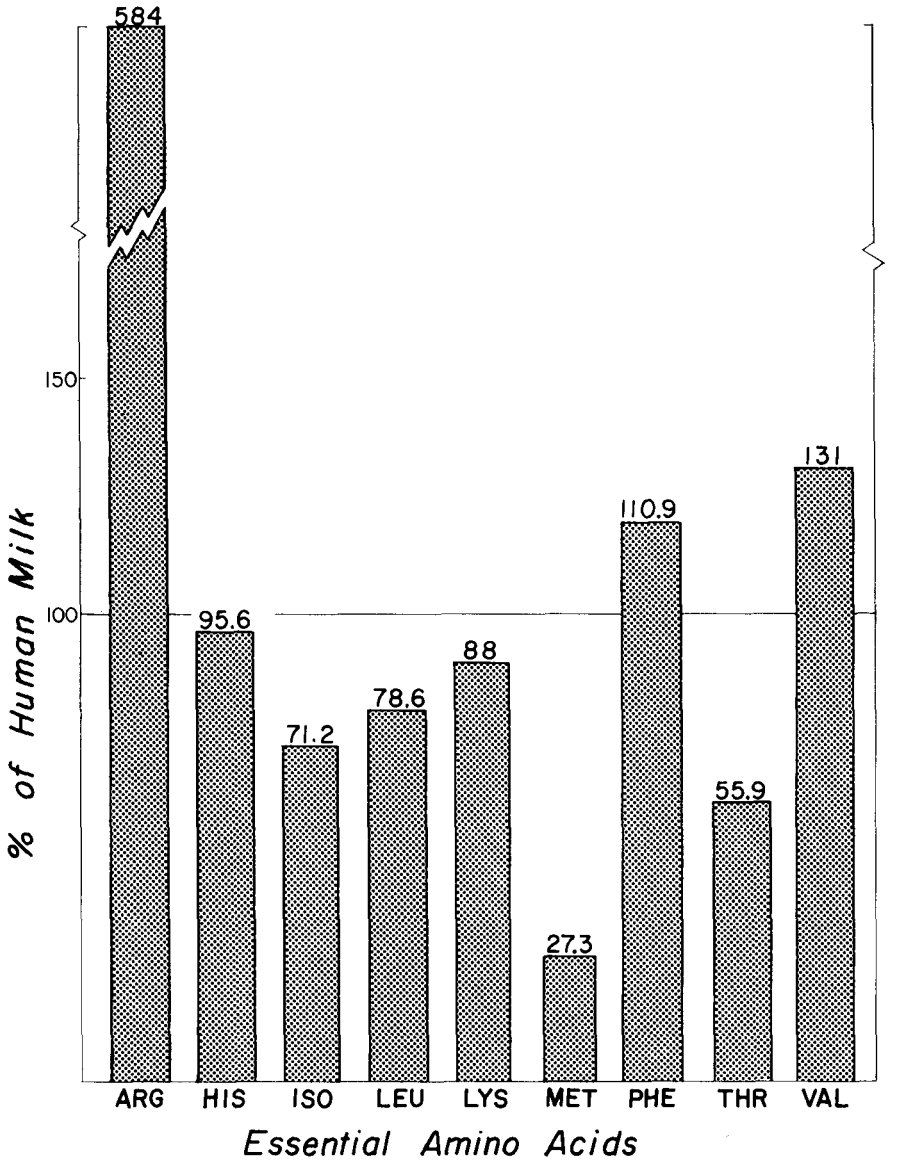

Fig. 8. Amino acid content of babassu kernel milk in comparison with mother's milk. Adapted from Governo do Estado do Maranhão (1973). ARG = arginine; HIS = histidine; ISO = isoleucine; LEU = leucine; LYS = lysine; MET = methionine; PHE = phenylalanine; THR = threonine; VAL = valine (redrawn by B. Angell).

sulfur and phosphorous content generates less pollution than mineral coals and other types of charcoal. However, only 25% of rural families interviewed in 3 municípios report that they sell charcoal, which is used predominantly for domestic purposes. People also burn babassu husks in smudgepots in the fields or at home to ward off insects. Condensed gases and tar collected from smoking babassu husks are sometimes used to alleviate toothaches through direct application on the gums. In remote areas of the Amazon Basin, babassu husks are used to smoke rubber.

TABLE 6. SUBSISTENCE USES OF BABASSU FRUITS.

Kernels	
Snack nut	
Milk	stewing meat and fish beverage
Liquid endosperm	treatment of sties and bleeding beverage
Oil	cooking soapmaking burning in lamps
Residues	animal feed substitute or filler for coffee shrimp bait
Larvae	food for people fish bait
Husks	
Charcoal	primary source of fuel for cooking
Smoke	insect repellant smoking rubber
Anesthetic	condensed gases and tar from burning used to alleviate toothache
Handicrafts	pencil holders, keychains, figurines
Mesocarp	
Animal feed	
Flour	substitute for manioc flour and former staple among Indian tribes chocolate-like beverage medicine for gastrointestinal complaints
Hunting	attractant for rodents

After removal of the external layers, the endocarp is occasionally cut into thin cross sections and used to produce craft items for the tourist trade in the region. Among articles encountered in shops are pencil holders, keychains, and figurines of animals and people.

The mesocarp of babassu fruits also serves a variety of purposes among rural households. After fruits are collected and dried, they are beaten several times with a club. This loosens the epicarp and pulverizes the dried mesocarp, which falls to the ground and is quickly set upon by pigs and fowl. Alternatively, people leave broken babassu husks in piles to be fed upon by animals prior to production of charcoal. The mesocarp's high starch content (60%) provides an excellent source of carbohydrate that is considered especially appropriate for pork fattening.

Among Indian groups such as the Guajajara in Maranhão and the Apinajé in Goiás, babassu mesocarp was once a principal staple and still constitutes a food source. After beating dried fruits with a club, the Indians pulverize the mesocarp in a mortar and pass it through a sieve. The flour is then moistened and toasted until dry. Babassu flour is consumed directly or as a porridge; like other flours, it can be stored for prolonged periods. Among rural families throughout the babassu zone, mesocarp flour is still used as a substitute for manioc flour during times of scarcity. People also mix unroasted mesocarp flour with water to treat

gastrointestinal complaints. This powder is encountered in natural medicine stores in northeast Brazilian capital cities, where it is marketed as a cure for a variety of ailments. People also mix the powder with milk and sugar, producing a chocolate-like drink. Subsistence uses of the babassu fruit are summarized in Table 6.

Finally, babassu's economic importance has earned it ritual significance in rural life. The Babassu Dance (*Dança do Côco*) is performed each year during the month-long celebrations leading up to St. John's Day on June 24th. Girls, wearing traditional dresses and carrying small baskets like those used for collecting kernels, circle around the boys while making motions of breaking fruits with small wooden hatchets. Around the time when babassu fruits begin to fall, several municípios hold an annual babassu party in a hall decorated with ripe fruit bunches and palm leaves.

FUTURE OF BABASSU

As described in this article, babassu provides a wide range of subsistence products to an estimated 450,000 rural households in Brazil or approximately 2 million people. In addition to cash income, the palm furnishes these people with food, fuel, and shelter. Economic activities related to babassu, such as fruit gathering and breaking, fit well into rural families' divison of labor and agricultural calendar. The palms play an important role in farming systems, providing organic matter, animal feed, and other services.

The subsistence benefits from babassu are currently threatened throughout the region by 2 processes. The first and more significant of these processes is pasture conversion, which is accelerating especially in the more humid portions of the region, due to attractive government subsidies for cattle raising. In most cases, large-scale establishment of improved pastures is accompanied by drastic thinning or clearcutting of babassu stands, as well as suppression of seedling emergence. It is not known how much area has been cleared of palms through this process, but from 1967 to 1981, some 77 such projects were approved for government-subsidized financing in Maranhão alone, on an area totalling over 1 million ha (Amaral Filho, 1983). Pasture conversion without public assistance accounts for additional clearcutting of the stands. Owners of modernized ranches are unlikely to allow small farmers to rent land for subsistence production or permit them to enter estates for collection of babassu fruit (Anderson and Anderson, 1983). Many families are forced to move to less rigidly controlled lands farther in the Amazon Basin, where they serve as the vanguard for the advancing agricultural frontier. With the subsequent arrival of ranchers, the conversion of cultivated lands to pastures begins and the cycle continues (Velho, 1972; Foweraker, 1981).

The second process is the recent development of technology for industrial breaking and separation of babassu fruits into their component parts. If adopted on a wide scale, this innovation promises sweeping changes in the current production system of babassu. Far fewer people will be needed to collect entire fruits than are currently employed in gathering and manually breaking fruits for kernel extraction (Mattar, 1979). Men have tended to displace women in babassu fruit harvesting in areas where this technology has been used, changing the labor allocation in rural households to the detriment of women's current role (Da Cunha, 1978). Finally, widespread sale of entire fruits to industries utilizing the new

technology implies that fewer products obtained from babassu fruits will be available to rural families for domestic use. A reduction in the subsistence products obtained from babassu fruits signifies a significant reduction in real income (Table 5). Rural people will have to pay for industrialized substitutes of the goods that they previously obtained free from the palm. Since the newly established industries that use entire fruits pay only on the basis of the value of the kernels (a share of which goes to landowners and intermediaries), it is doubtful whether the majority of people dependent on babassu stand to gain by this change.

Reversal of the current clearcutting of babassu will require more efficient ways to combine the palm with pastures and crops in regional production systems. To aid in this effort, a supportive public policy could encourage babassu palm retention at moderate densities as a condition for approval of government-subsidized pasture establishment projects. Rather than decrease employment opportunities, the new technology for cracking and separating usable fruit fractions could potentially increase these opportunities if it were scaled down to the level of the rural producers. In addition to developing appropriate technology, returns to rural families could be increased through the organization and support of cooperatives that carry out small-scale processing, storage, and marketing of babassu products directly to regional industries and consumers.

In the long run, the survival of the palm forest and maintaining the flow of subsistence benefits from babassu depend upon efforts to improve the palm's productivity as a permanent component of agricultural systems. Early research results suggest that babassu may have potential as a plantation crop or as a promising species for reforestation of marginal lands in the tropics. Wide-ranging collections of germplasm from native populations have revealed that individual fruits may contain up to 17% kernel; some palms yield 4–5 panicles of fruits annually, while others demonstrate a higher ratio of fruit bearing to male inflorescences. Apparent natural hybrids of babassu with associated palm species are tolerant of poor soil and moisture conditions and begin to fruit when the palm is young. Seed specimens from such precocious individuals have been recovered from the wild and established in an active germplasm bank in Maranhão, serving as the basis for further selection and genetic improvement. Nursery propagation trials have already shown dramatic responses in germination rates and seed viability, with germination reduced from the average of 3 mo found in prior studies to less than 2 wk in the nursery (Frazão and Pinheiro, 1985). Other promising areas for babassu productivity-enhancement research include measuring fruit production response to thinning of native stands, soil fertility variations and water availability, and introduction of mycorrhizae.

Research priorities for babassu domestication must be articulated sensitively to ensure that the benefits from such research attain their widest possible distribution. The pressures for change that affect the babassu zone of Brazil are similar to those transforming other rural areas in many developing countries. The presence of babassu, a palm that is well adapted to the region's major land uses and closely meshed with its agricultural economy, makes this zone unusual. The many important subsistence values derived from babassu justify continued efforts to preserve and widen these benefits as an integral part of development programs in this and other regions where similar palms abound.

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Society for Economic Botany 1985 Meeting

In 1985, the Society for Economic Botany will participate in the American Institute of Biological Sciences 36th Annual Meeting, which will be held at the University of Florida in Gainesville, from August 11–15, 1985. A joint symposium of the Society for Economic Botany and the Section for Economic Botany of the Botanical Society of America, organized by **Drs. W. H. Eshbaugh and G. Wilkes,** has been titled **"Economic Botany in the Year 2000."** Already named as symposium speakers are **Drs. Gurdip Brar, Donald N. Duuick, C. Earle Smith, Jr., Charles Hieser, Jr., Jerome Miksche, Donald Plucknett, and Varro Tyler.** While the title of each speaker's talk has not yet been announced, a wide range of topics that impinge on economic botany will be discussed.

It is also planned to have a luncheon banquet at which **Dr. Jack R. Harlan** will be honored as this year's Distinguished Economic Botanist. A field trip is also in the planning stages. As of now, details of registration costs and housing fees are not available, but it may be expected that a choice of reasonably priced motel and dormitory accommodation will be available.