

## 4 ASIAN REGION

The Asian region is an immense area containing the greatest palm species diversity in the world along with the oldest and most assorted types of palm utilization. For the purpose of this chapter, Asia is defined geographically as stretching from Pakistan on the west to Indonesia on the east and north to include China.

Across the region, the level of knowledge about palm systematics and documented examples of particular palm products ranges from excellent to fragmentary. Malaysia represents a country in the former category, Vietnam one of the latter. A World Wide Fund for Nature Asian palm project which focused on India, Indonesia, Malaysia and the Philippines summarized old and generated much new information on conservation and utilization (Johnson, 1991b). Additional investigations are needed to include more countries.

Chapter 4 has been broken down into three separate but interrelated parts to simplify dealing with such a large number of palms. The first part is concerned with the palms of South Asia, i.e. India, Bangladesh, and Sri Lanka; and to a minor degree with Pakistan, Nepal, Bhutan and Sikkim. Part two covers Southeast Asian palms and includes the countries from Myanmar eastward to Indonesia and the Philippines, and southern China. These two regional treatments exclude rattans which are dealt with as a group in a separate third section of this chapter.

The approach in this and the following regional chapters links together utilization and conservation because without such a linkage sustainable resource use can never be achieved. The conservation status of a utilized wild palm is a vital piece of information in any consideration of continued or expanded exploitation. For convenience, palm species are considered to be in one of three conservation categories: threatened, non-threatened or unknown. Except for rattans in this chapter, utilized palms with an unknown conservation status are not discussed because they lack as well reliable information on utilization.

### South Asia

The utilized native palms of this region, excluding rattans, were divided into two groups based on their conservation status.

#### Threatened South Asian Palms

Thirteen species of native South Asian palms were found to be both under threat in the wild and utilized by local people; there are undoubtedly many more. Information on these palms is presented in Table 4-1. The strong relationship between sensitive island habitats and threatened palms is in evidence in Table 4-1 where half the species included occur on islands. One island endemic is also monotypic (i.e. a genus with a single species): *Loxococcus rupicola* in Sri Lanka.

**Discussion**

Perusal of the palm products in Table 4-1 shows that leaves, petioles and stems are exploited for a variety of end-uses; and fruits, sap and starch provide edible products. All these existing patterns of utilization are for subsistence purposes alone.

Table 4-1 Threatened South Asian Palms with Reported uses (excluding rattans)\*

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>	Products/Uses
<i>Areca concinna</i>	lenteri	Sri Lanka (endemic)	nuts as betel substitute
<i>Arenga wightii</i>	dhiudasal. alam panel	India: Karnataka, Kerala, Tamil Nadu (endemic to India)	peduncle tapped for sap; stem starch
<i>Bentincckia nicobarica</i>	Nicobar bentincckia palm	India: Great Nicobar Island (endemic)	leaves for thatching and stems as hut pillars
<i>Corypha umbraculifera</i>	condapana; tala	India: Kerala; Sri Lanka	leaves used as umbrellas; edible starch from stem; seeds to make beads; formerly, leaf blades as writing material
<i>Hyphaene dichotoma</i>	oka mundel (Indian doum palm)	India: Gujarat. Maharashtra (endemic to India)	fibrous fruit mesocarp (see Table 9-20 for composition) & unripe kernel eaten; leaves for thatching; stem wood for posts, roof beams & fuel
<i>Licuala peltata</i>	selai pathi, mota pathi	Bangladesh; India: Andaman Islands, Northeast; Sikkim	leaves for thatching & as rain hats. split leaf blades woven into baskets, mats, etc.; stems as pillars
<i>Livistona jenkinsiana</i>	toko pat, takau-araung	India: Northeast; Sikkim	fresh nuts used as masticatory; leaves for thatching & rain hats, stems for hut construction
<i>Loxococcus rupicola</i> (monotypic)	dotalu	Sri Lanka (endemic)	edible palm heart
<i>Oncosperma fasciculatum</i>	katu-kitul	Sri Lanka (endemic)	stem wood for construction ?

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>	Products/Uses
<i>Phoenix rupicola</i>	cliff date palm ?	India: Arunachal Pradesh, Meghalaya; Sikkim	starch extracted from stem as famine food
1. <i>Pinanga dicksonii</i> ; 2. <i>P. manii</i>		1. India: Kerala, Tamil Nadu (endemic to India); 2. India: Andaman & Nicobar Islands (endemic)	1 & 2. stems used for fencing & posts; leaves for thatching; nuts used as betel substitute
<i>Wallichia disticha</i>	tashe	Bangladesh; Bhutan; India: Arunachal Pradesh, West Bengal; Sikkim	edible stem starch

Notes:

\* See also Table under Chapter 13.

1. Other local names are given in some of the sources below.

2. Distribution is within the South Asian region as defined; some species also occur elsewhere.

Sources: Basu, 1991; Basu & Chakraverty, 1994; Blatter, 1926; De Zoysa, 1996; Henderson, 2009; Jolla & Joseph, 1962; Mahabale, 1982; Malik, 1984; Manihottam, 2004; Mathew & Abraham 1994; Renuka, 1999; Sree Kumar & Coomar, 1999

From a utilization standpoint, it should be possible to reduce the exploitation of these threatened palms inasmuch as there are inexpensive alternative sources of the palm products, either from other palm species or other plants.

A combination of utilization and habitat destruction appears to have led to the extinction in the wild of the tara palm (*Corypha taliera*) endemic to West Bengal, India. Leaves were formerly used for tying rafters of houses and leaf blades employed as writing material. Although no longer found in its natural habitat, the tara palm is under cultivation in botanic gardens, affording an opportunity for a reintroduction effort.

On a more positive note, recognition in Thailand of the overexploitation of the naturalized talipot palm (*Corphyra umbraculifera*) has led to its inclusion in a list of the protected non-wood forest products. Under forest regulations, small amounts of protected NWFs can be harvested for subsistence needs, but any commercial exploitation requires a permit (Subansenee, 1995).

### **Non-threatened South Asian Palms**

About the same number of economic palms are not under threat in South Asia. *Nypa fruticans* is included as one of the dozen species in Table 4-2 despite the fact that it is threatened in Sri Lanka and should be given protection there. Sri Lanka represents the western limit of the palm's natural range, where it occurs only in a small estuarine area of the island.

### **Discussion**

The small number of species in Table 4-2 should not be construed as an indication that palms are of minor significance in the region. To the contrary, palms are quite important and provide a great range of different products for subsistence and commercial purposes.

*Arenga pinnata*, *Borassus flabellifer* and *Phoenix sylvestris* are all multipurpose species that individually approach the coconut palm in terms of overall utility. One product common to the three palms is sap which is consumed in the form of soft or fermented and distilled alcoholic beverages, made into vinegar or boiled down (when fresh) to yield palm sugar which is comparable chemically to cane, beet or maple sugar. Over many centuries, tapping techniques have been developed which enhance sap flow while minimizing the negative impact on the individual tree. The monotypic *Nypa fruticans* is also a source of sweet sap but it is not as important in South Asia as it is Southeast Asia.

With the exception of *Areca triandra*, all the palms in Table 4-2 are exploited for leaf products of one kind or another. Cottage industries producing hats, bags, mats and other products woven from pliable young palm leaves are common in South Asia and the products are of the highest quality.

The importance of non-wood forest products is officially recognized in Bangladesh where *Nypa fruticans* and *Phoenix paludosa* harvest requires permits from the Forest Department (Basit, 1995).

Two recent studies of *Phoenix sylvestris* in Bangladesh looked at sustainable approaches to sap production, which is an important seasonal subsistence to yield a sweet sap beverage or reduced by boiling to syrup; cottage industry fermented and distilled alcoholic beverages also are made (Chowdhury *et al.*, 2008; Halim *et al.*, 2008).

Stem starch derived from *Caryota urens* in India represents a food source among some tribal peoples (Anila Kumai and Rajyalakshmi, 2000; Manihottam, 2004). This product is quite similar to the starch from sago palm (*Metroxylon sagu*) in Southeast Asia.

It is obvious that many if not most of these non-threatened palms could be brought under better management and the production of palm products increased on a sustainable basis. Research along these lines is being carried out in South India at the Kerala Forest Research Institute where a project focused on the palm resources of Kerala, their conservation and utilization is ongoing and has produced several excellent publications.

**Table 4-2** *Non-threatened South Asian Palms with Reported Uses (excluding rattans)*

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>	Products/Uses
<i>Areca triandra</i>	<i>bon gua</i>	India: Andaman Islands, Northeast	nuts used as betel substitute
<i>Arenga pinnata</i>	<i>gomuti (sugar palm)</i>	Bangladesh; India: Andaman Islands, Eastern; Sri Lanka	multipurpose palm; sap for sugar & other products; edible immature seed (fresh mesocarp of ripe fruit is filled with irritant needle crystals); edible starch from stem; edible palm heart; leaf base fiber for fish nets, etc., leaflets for weaving baskets, etc., stem wood for various uses
<i>Borassus flabellifer</i>	<i>tal, palmyra</i>	Bangladesh; India; Sri Lanka	multipurpose palm: sap for toddy & sugar; edible mesocarp pulp; edible unripe endosperm, edible palm heart; leaves for thatching; leaflets for weaving, stem wood for construction & fuel, see Table 9-5 and Table 9-6 for composition of sap & sugar
<i>Caryota mitis</i> ; <i>C. urens</i>	<i>2. bherli mad, kittul</i>	India: Andaman Islands; Bangladesh; India; Nepal; Sri Lanka	1. edible starch from stem; leaves for thatching, weaving & decoration, ripe fruits contain irritant poison. 2. leaf-sheath fiber to make rope, etc.; edible starch from stem; sap for toddy & sugar. edible palm heart; seeds as masticatory & to make beads
<i>Licuala spinosa</i>	<i>jungli selai</i>	India: Andaman Islands	leaves for thatching & clothing
<i>Livistona jenkinsiana</i>	?	Bangladesh; India; Sikkim;	leaves for thatch & hats; edible palm heart
<i>Nypa fruticans (monotypic)</i>	<i>golpata</i>	Bangladesh; India: Andaman Islands, Orissa, West Bengal; Sri Lanka	leaves for thatching, sap from inflorescence for beverage or sugar; mature seeds suitable for vegetable ivory

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>	Products/Uses
<p><i>Phoenix acaulis</i>;</p> <p><i>P .loureiri</i>;</p> <p><i>P. paludosa</i>;</p> <p><i>P. pusilla</i>;</p> <p><i>P. sylvestris</i></p>	<p>1. <i>khajur</i>;</p> <p>2. <i>khajoor</i>;</p> <p>3. <i>hantal</i>;</p> <p>4. <i>indi</i>;</p> <p>5. <i>thakil (sugar date palm)</i></p>	<p>1. <i>India: Meghalaya, Uttar Pradesh; Nepal: Sikkim</i>;</p> <p>2. <i>India: Kerala, Uttar Pradesh; Nepal; Pakistan</i>;</p> <p>3. <i>Bangladesh; India: Andaman Islands, Bengal, Orissa; Bangladesh</i>;</p> <p>4. <i>India: Tamil Nadu; Sri Lanka</i>;</p> <p>5. <i>India (common); Nepal</i></p>	<p>1. <i>edible fruit, heart &amp; stem starch; leaf fiber for ropes, leaves for thatching</i>;</p> <p>2. <i>leaves woven into mats &amp; to make brooms; edible fruit; starch from stem; medicinal use of palm heart</i>;</p> <p>3. <i>stem wood for construction, leaves for thatching &amp; to make brooms, leaf fiber to make rope, edible fruit?</i>;</p> <p>4. <i>edible fruit, leaves woven into mats and baskets; split petiole to make baskets; edible starch from stem</i>;</p> <p>5. <i>multipurpose palm: sap from stem as beverage &amp; to make sugar, edible fruit: leaves made into brooms or woven into baskets &amp; mats; stem wood for fuel</i></p>

## Notes:

1. Other local names are given in some of the sources cited.
  2. Distribution is within the South Asian region as defined; some species also occur elsewhere.
- Sources: References for Table 4-1 and in addition: Anila Kumai, & Rajyalakshmi, 2000; Basit, 1995; Chowdhury et al., 2008; Davis, 1972, 1988; Davis & Johnson, 1987; Davis & Joel, 1989; De Zoysa, 1992; Dissanayake, 1986; Dowe, 2009; Francis, 1984; Ghosh & Ghose, 1995; Halim, et al., 2008; Kovoov, 1983; Miller, 1964; Padmanabian & Sudhersan, 1988; Pongssattayappat & Barfod, 2005; Renuka, 1999; Seneviratne et al., 2007



If information were available on its conservation status, the useful mazari palm (*Nannorrhops ritchiana*), a monotypic palm, would probably be included in Table 4-2. This monotypic palm is native to arid portions of northwestern India, Pakistan and westward to the Arabian Peninsula, and has a variety of uses. For example: leaves are woven into mats and baskets, made into fans and brushes, and have medicinal use; stems, leaves and petioles serve as fuel; young leaves and inflorescences, as well as the heart and fruit are eaten; and seeds are made into beads. Gibbons and Spanner (1995) described this palm and its utilization in Pakistan.

## **Southeast Asia**

Native palms currently reported to be exploited in Southeast Asia also have been broken down into threatened and non-threatened species lists. Considerable knowledge gaps exist about palms in this very diverse area, especially in Myanmar, Thailand, the countries of the former Indochina and the Indonesian province of Papua on the island of New Guinea.

### **Threatened Southeast Asian Palms**

A total of 22 palm species, belonging to 13 genera, are listed in Table 4-3. More than one-half of these species are endemic palms and most countries in the region are represented. They are, therefore, fairly representative of the situation.

Three genera are among the largest non-rattan palm genera in Asia: *Licuala* about 134; *Pinanga* has around 131 and *Areca* approximately 47 species. Each genus has numerous species for which conservation data are lacking and there is justifiable concern that when data are available the results will be alarming and show that most are also threatened. The reason for this concern is that the habitat of all three genera is the undergrowth of tropical forests, and Southeast Asian forests are under intense pressure from logging, shifting cultivation and conversion to permanent agriculture or grazing, resulting in deforestation and degradation on a massive scale.

Another aspect of the genera in Table 4-3 is that several species of *Areca*, *Arenga*, *Caryota*, *Eugeissona*, *Licuala*, *Livistona*, *Phoenix* and *Pinanga* also appear in Table 4-4 among the listing of non-threatened palms. Inasmuch as palm genera have distinctive individual habitat requirements, the linkage between threatened and non-threatened congeneric species needs to be kept in mind in promoting palm products. In other words, it is not sufficient to know that an individual species is not threatened; taking into account other species (which often yield similar products) is the safest approach to follow.

## **Discussion**

Food and non-food products are about equally represented in Table 4-3 and appear to be solely for subsistence purposes. Some palm utilizations are relatively benign, such as collecting the fruits of *Pinanga* spp. and other *Areca* spp. as a substitute for the cultivated betel nut (*Areca catechu*). Leaf harvest for thatching and other end uses may or may not be of concern, depending upon the intensity of the practices.

Table 4-3 Threatened Southeast Asian Palms with Reported Uses (excluding rattans)\*

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>	Product/Uses
1. <i>Areca hutchinsoniana</i> ; 2. <i>A. ipot</i> ; 3. <i>A. macrocarpa</i> ; 4. <i>A. .parens</i>	1. bunga; 2. bungang-ipot; 3. bungang-lakihan; 4. takobtab	1. Philippines: Mindanao, 2. Luzon, 3. Zamboanga, 4. Luzon (each species in endemic)	nuts as occasional betel substitute; edible palm heart
<i>Arenga hastata</i>	mudor	Borneo; Malaysia: Peninsular	leaf sheath as knife sheath
<i>Borassodendron borneense</i>	bidang	Borneo (endemic)	edible palm heart & immature fruit endosperm; stem sawn into boards for house construction
1. <i>Carvota no</i> ; 2. <i>C. rumphiana</i>	1. entibap mudol; 2. takipan	1. Borneo (endemic); 2. Indonesia; Moluccas, Papua; Philippines: Luzon;	1. edible stem starch & palm heart leaf-sheath fiber for tinder & to make fishing line, etc.; 2. edible palm heart
<i>Eugeissona brachystachys</i>	tahan bertam	Malaysia: Peninsular (endemic)	edible stem starch; leaves for thatching; edible immature endosperm; petioles to make darts etc.
<i>Heterospathe elmeri</i>		Philippines: Camiguin (endemic)	nuts as betel substitute; edible palm heart
<i>Johannesteijsmannia altifrons</i> ; <i>J. lanceolata</i> , <i>J. magnifica</i> , <i>J. perakensis</i>	<i>J. sal</i>	1. Indonesia: Sumatra; Malaysia: Peninsular, Sarawak; Thailand 2. Malaysia: Peninsular (all endemic)	1. leaves for thatching roots & walls; fruits in medicine, 2. seed collected for ornamental planting

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>	Product/Uses
<i>Licuala fatua</i> ; <i>L. orbicularis</i>	1. <i>cay trui</i> ; 2. <i>biru balat</i>	1. Vietnam: <i>Ila Nam Ninh, Tua Thien</i> (endemic); 2. Malaysia: <i>Sarawak</i> (endemic)	1. stems to make tool handles; 2. leaves for wrapping, making hats, umbrellas & thatching
<i>Livistona robinsoniana</i>		Philippines: <i>Polillo</i> (endemic)	leaves for thatching, stems as posts
<i>Orania sylvicola</i>	<i>iwul</i>	Indonesia: <i>Java, Sumatra</i> ; Malaysia: <i>Peninsular, Sarawak</i> ; Thailand	stem wood for construction poisonous heart & fruit (said to apply to all <i>Orania</i> species)
<i>Phoenix loureiroi</i> var. <i>loureiroi</i>	<i>voyavoy</i>	Philippines: <i>Batanes Islands</i>	leaves to make thatched raincoat; leaflets woven into mats
<i>Pholidocarpus kingianus</i> ; <i>P. macrocarpus</i>	2. <i>serdang</i>	Malaysia: <i>Peninsular</i> (endemic); Malaysia: <i>Peninsular</i> ; Thailand	1 & 2. stems for pilings & timber; leaves for thatching
<i>Pinanga cochinchinensis</i> ; <i>P. dupperreana</i> ; <i>P. punicea</i> var. <i>punicea</i>	<i>cao cuóc cluóc</i> ; <i>sla condor</i>	1. Vietnam (endemic); 2. Cambodia; Laos; Vietnam; 3. Indonesia: <i>Moluccas, Papua</i>	1. fruit used as fish bait, leaves to make mats & sails; 2. edible palm heart; nuts as betel substitute; 3. leaves to make mats & sails

## Notes:

\* See also Table under Chapter 13.

1. Other local names are given in some of the sources cited.

2. Distribution is within the southeast Asian region as defined; some species also occur elsewhere.

Sources: Brown & Merrill. 1919; Burkill, 1966; Davis, 1988; Dransfield et al., 2008; Fernando, 1990; Gagnepain, 1937; Guzman & Fernando, 1996; Henderson, 2009; Kiew 1991; Maculid, 1991a,b; Moge, 1991; Pearce, 1991, 1994; Whitmore, 1973.

The spectacular umbrella leaf palm (*Johannesteijsmannia altifrons*) is a case in point. Sometimes referred to as nature's answer to corrugated iron, the very large undivided leaves are up to 3 m long and 1 m wide. Highly prized for thatching roofs and walls (which last 3-4 years) the leaves are cut and sold for this purpose in Peninsular Malaysia. As long as 2-3 leaves are left on each plant, the practice may be sustainable (Kiew, 1991). However, little is known about the flowering and fruiting characteristics of palms in this genus; periodic leaf harvest could, over time, adversely affect fruit production and lead to a decline in natural regeneration. This biological factor is apart from habitat destruction; these palms require an understory forest habitat. In addition, illegal seed collection and export of these highly-desirable ornamental palms is having detrimental effects on the wild populations in Peninsular Malaysia.

The most destructive exploitation of threatened palms occurs in extracting edible palm hearts and edible stem starch for the trees are destroyed in the process. In some instances it appears that palm heart extraction is associated with felling a tree for some other purposes such as to obtain stem wood or starch; it is therefore sometimes a "salvage" product, to use the term introduced in Chapter 3.

By and large, the products derived from palms in Table 4-3 are for subsistence needs and alternative sources could and should be suggested where the current exploitation is having a serious negative impact on wild palm populations.

### **Non-threatened Southeast Asian Palms**

The full range of palm utilization in Southeast Asia is represented in Table 4-4 which lists 40 species in 18 genera. Geographic coverage is complete as every country in the region is included, although with varying completeness. The table is a clear indication of the fact that Southeast Asia has both the highest palm species diversity and the greatest variety of palm utilization of anywhere in the world.

*Arenga*, *Phoenix*, *Pinanga* and *Salacca* species account for around one-half of the entries in the table. The palm genera *Eleiodoxa* and *Eugeissona* occur only in Southeast Asia.

### **Discussion**

Table 4-4 includes six major economic palm species, each one worthy of individual attention. They are: *Arenga pinnata*, *Borassus flabellifer*, *Corypha utan*, *Metroxylon sagu*, *Nypa fruticans* and *Salacca zalacca*. These and additional species are discussed further in Chapter 8 as candidates for greater management and/or outright domestication.

***Arenga pinnata*.** The aren or sugar palm is a multipurpose solitary palm species which finds its greatest utility in Southeast Asia. Miller (1964) provides an excellent summary of the economic uses of the palm. Known chiefly as a source of sap derived from tapping the inflorescence to make sugar and a provider of edible starch from the trunk, the sugar palm grows in humid forest areas and under drier conditions. The fruit of the sugar palm fruit merits special attention because although the immature endosperm is edible, the mesocarp pulp of ripe fruits contains irritating needle crystals which make them inedible. Black coarse leaf-base fiber is used for a variety of subsistence and commercial uses, such as rope and

fishnets, because of its durability and resistance to the action of sea water. Recently, the physical properties of fiber have been studied for their use in reinforced epoxy composites, with encouraging results (Sastra *et al.*, 2005, 2006).

The growth habit of the sugar palm is notable with respect to its products. The palm is hapazanthic, i.e. it flowers at about 10 years of age and dies. The harvestable quantities of sap and starch represent the tree's stored nutrients for the protracted flowering and fruiting which extends over a period of about two years.

Table 4-4 Non-threatened Southeast Asian Palms with Reported Uses (excluding rattans)

Scientific Names	Selected Local Names	Distribution'	Products/Uses
<i>Areca macrocalyx</i> ; <i>A. triandra</i>	2. <i>cau rung</i> (Viet)	1. <i>Indonesia: Papua</i> ; 2. <i>Cambodia; Indonesia; Lao; Malaysia; Peninsular; Myanmar; Philippines; Thailand; Vietnam</i>	1. (inferred) nut as betel substitute; edible heart; leaves for thatch; 2. nut as betel substitute
<i>Arenga microcarpa</i> ; <i>A. obtusifolia</i> ; <i>A. pinnata</i> ; <i>A. tremula</i> ; <i>A. undulatifolia</i>	2. <i>langkap</i> (Pen Mal.) 3. <i>aren</i> ; 4. <i>dumayaka</i> (Phil); 5. <i>aping</i>	1. <i>Indonesia: Papua</i> ; 2.; <i>Indonesia: Java, Sumatra; Malaysia: Peninsular</i> ; 3. <i>widespread</i> ; 4. <i>Philippines: Luzon</i> ; 5. <i>Borneo; Indonesia: Sulawesi; Philippines: Sulu</i>	1. <i>edible palm heart</i> ; 2. <i>edible palm heart &amp; endosperm</i> ; 3. <i>multipurpose palm: sap for sugar &amp; other products; edible immature seed (fresh mesocarp of ripe fruit is filled with irritant needle crystals) edible stem starch, palm heart leaf-base fiber for fish nets, in composition board etc.; leaflets for weaving baskets, etc.</i> ; 4. <i>petiole split to make baskets</i> ; 5. <i>edible stem starch (Sarawak) &amp; other products</i>
<i>Borassus flabellifer</i>	<i>lontar</i>	<i>widespread as native &amp; cultivated species</i>	<i>multipurpose palm: sap for toddy &amp; sugar; edible mesocarp pulp; edible unripe endosperm; edible palm heart; leaves for thatching; leaflets for weaving, stem wood for construction &amp; fuel</i>

Scientific Names	Selected Local Names	Distribution'	Products/Uses
<i>Caryota mitis</i> ; <i>C. rumphiana</i>	1. <i>mudor</i> (Sar); 2. <i>sagu moro</i> (Irian)	1. Brunei; China: Hainan Island (where it is threatened); Indonesia: Java, Sulawesi; Malaysia: Peninsular, Sarawak; Myanmar; Thailand; Vietnam; 2. Indonesia: Moluccas, Papua	1 & 2. edible palm heart & stem starch
<i>Corypha lecomtei</i> ; <i>C. utan</i>	1. <i>ta buong</i> (Viet); 2. <i>gebang, hurt</i>	1. Thailand; Vietnam 2. Indonesia: Java, Kalimantan, Sulawesi, Sumatra; Malaysia: Peninsular, Sabah; Philippines	1. leaves for thatching & weaving mats, sails and bags; petiole to make arrows & walking sticks; edible stem starch; fruits as fish poison, 2. stem starch as food & medicine; sap from inflorescence for wine & sugar; edible palm heart; edible fruit (see Table 9-14 for nutritional composition); leaves for thatching & weaving mats, baskets & fans
<i>Eleiodoxa conferta</i>	<i>kelubi</i>	Brunei; Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Singapore; Thailand	fruit used to make pickles & relishes; edible palm heart; leaves for thatching & to make mats
<i>Eugeissona tristis</i> ; <i>E. utilis</i>	1. <i>bertam</i> ; 2. <i>nanga</i>	Malaysia: Peninsular; Thailand; Borneo	1. leaves for thatching & to make fish traps; edible immature fruit; 2. stem starch; edible palm heart, purple flower pollen used as condiment; leaves for thatching, split petiole to make darts

Scientific Names	Selected Local Names	Distribution'	Products/Uses
<i>Hydriastele costata</i>	limbun	Indonesia: Moluccas, Papua	stems for floor and wall boards; inflorescence used as brush; leaf sheath of crown shaft folded to make buckets & baskets and to wrap food
<i>Licuala pelhata</i> ; <i>L. spinosa</i>	1 & 2. palas (Indon)	1. Myanmar; Thailand 2. Brunei; China; Indonesia: Java, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Philippines; Thailand	1 & 2. leaves for thatching & to wrap food
<i>Livistona rotundifolia</i>	serdang	Borneo; Indonesia: Moluccas, Sulawesi; Philippines	leaves for thatching and to wrap food
<i>Metroxylon sagu</i>	sagu	Indonesia: Moluccas, Papua; Philippines: Mindanao	stem starch; leaves for thatching, petioles & stem wood for construction, etc.
<i>Nypa fruticans</i> (monotypic)	nipah, atap	widespread in coastal areas	leaves for thatching & weaving; sap from inflorescence for beverage, sugar or alcohol; immature seeds edible, mature seeds suitable for vegetable ivory; leaflet epidermis to make cigarette wrapper; leaf powder as corrosion inhibitor of zinc



Scientific Names	Selected Local Names	Distribution'	Products/Uses
<i>Oncosperma horridum</i> ; <i>O. tigillarum</i>	1. bayas (Malay), bayeh (Indon), 2. nibong (Malay)	1. Brunei; Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Philippines; Thailand 2. Brunei; Cambodia; Indonesia: Java, Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Philippines; Vietnam	1 & 2. whole stems resistant to sea water, used in construction; stems split into strips to make fish traps, floor & wall coverings, etc.; leaves to weave baskets; nuts as betel substitute; edible etc.; leaves to weave baskets; nuts as betel substitute; edible palm heart
<i>Phoenix acaulis</i> ; <i>P. loureirii</i> ; <i>P. paludosa</i> ; <i>P. sylvestris</i>	2. bua cha la (Viet); 3. cay cut chut (Viet)	1. Myanmar; Thailand; Vietnam; 2. China; Thailand; 3. Indonesia: Sumatra; Malaysia: Peninsular; Thailand; Vietnam; 4. Myanmar	1. edible fruit leaf fiber for ropes leaves for thatching; 2. edible fruit; other uses likely; 3. edible fruit and palm heart; leaves for temporary fencing; 4. (inferred) multipurpose palm sap from stem as beverage & to make sugar; edible fruit; leaves made into brooms or woven into baskets & mats; stem wood for fuel
<i>Pigafetta filaris</i>	wanga	Indonesia: Moluccas, Papua, Sulawesi	whole stems used in construction, split or sawn into flooring & hollowed for water pipe, to make furniture
<i>Pinanga caesia</i> ; <i>P. coronata</i> ; <i>P. crassipes</i> ; <i>P. mooreana</i> ; <i>P. scortechinii</i> ; <i>P. simplicifrons</i>	Pinarig, in general	1. Indonesia: Sulawesi (endemic); 2. Indonesia: Java, Sumatra; 3. Malaysia: Sabah, Sarawak; 4. Brunei; Malaysia: Sarawak; 5. Malaysia: Peninsular; Thailand; 6. Brunei; Indonesia: Sumatra Malaysia: Peninsular, Sarawak	(in general) leaves for thatching; stems as laths, nuts sometimes chewed as betel substitut

Scientific Names	Selected Local Names	Distribution'	Products/Uses
<p><i>Salacca affinis</i>;  <i>S. glabrescens</i>;  <i>S. vernicularis</i>;  <i>S. wallichiana</i>;  <i>S. zalacca</i></p>	<p>1. <i>salak, ridan (Sar)</i>;  2. <i>salak</i>;  3. <i>kepla</i>;  5. <i>salak</i></p>	<p>1. Brunei; Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak;  2. Malaysia: Peninsular; Thailand;  3. Borneo;  4. Cambodia; China; Lao; Malaysia: Peninsular; Myanmar; Thailand; Vietnam ;  5. Indonesia: Java, Sumatra</p>	<p>1. edible fruit &amp; palm heart; flexible end of rachis as fishing rod;  2. edible fruit;  3. edible fruit and palm heart;  4. fruit used in curry; petioles for fishing rods;  5. edible fruit (see Table 9-25 for nutritional composition) leaves for fencing &amp; decoration</p>
<p><i>Trachycarpus fortunei</i></p>	<p><i>chusan</i></p>	<p>China (endemic)</p>	<p>leaf-base fiber to make rope, mats, brushes; leaves for thatching &amp; to weave fans, hats, chairs; fruit wax to make polishes, etc., seed source of hemostatic drug; roots, leaves &amp; flowers contain medicinal compounds; stems as house pillars, edible flowers; seeds as animal fodder</p>

## Notes:

1. Other local names are given in some of the sources cited.
  2. Distribution is within the Southeast Asian region as defined; some species also occur elsewhere.
- Sources: References for Table 4-3 and in addition: Ashari, 2002; Barrow, 1998; Davis, 1988; Davis & Kuswara, 1987; Davis et al., 1990, Dransfield, 1977; Dransfield & Johnson, 1991; Ellen, R., 2004; Essig, 1982; Essig & Dong, 1987; Fong, 1989, 1991; Fox, 1977; Hay, 1984; House, 1983; Kovoor, 1983; Lubeigt, 1977; Miller, 1964; Moge et al., 1991, O'Brien & Kinnaid, 1996, Orubite-Okorosaye & Oforka, 2004; Rotinsulu, 2001; Ruddle et al., 1978; Sastra et al., 2006; Sastrapradja et al., 1978; Schuiling, 2009; Yaacob & Subhadrabandhu, 1995.

***Borassus flabellifer***. The lontar palm is a multipurpose species, also a solitary palm, in Southeast Asia just as it is in South Asia. However, its uses do not quite reach the diversity found in South Asia. This is documented by Fox (1977) who studied two different culture groups which make considerable use of the palm on the Indonesian islands of Roti and Madura. As a sugar source, lontar has been studied in great detail by Lubeigt (1979) in central Myanmar. The lontar is a palm of dry environments and is tolerant of poor soils. Its major drawback as an economic palm is that it is a single-stemmed species.

***Corypha utan***. This palm has a very wide distribution in Asia, most often in drier more open areas. It typically is found in association with settlements, suggesting that humans may have contributed to its current geographic range. A large single-stemmed tree, the gebang palm shares with the sugar palm a terminal-flowering habit and also its main economic products of sweet sap and stem starch. The gebang has very large fan-shaped leaves with numerous uses.

***Metroxylon sagu***. The sago palm is most notable in the region as a subsistence source of stem starch in areas of its occurrence in Indonesia and the Philippines. A tropical peat swamp palm, sago occupies a largely undesirable habitat as far as competing land use is concerned. Centuries ago, sago was introduced from farther east to Borneo and Malaya, apparently by migrating peoples. Today it can be found in a semi-wild or cultivated state where suitable habitat exists. Anyone seeing the extensive sago areas in Sarawak, and the dependence of local people on it for starch and various other projects, would find it difficult to believe that the palm is not native. This hapazanthic suckering palm is discussed in more detail in Chapter 5.

***Nypa fruticans***. Nipa is solely a mangrove palm and its distribution is centered in Southeast Asia. Although sago and nipa occupy somewhat similar habitats, the former grows in fresh water swamps, the latter brackish water environments along the coast. Major economic products are sap for sugar or alcohol and leaves for thatching. Panels of nipa thatch (atap) are in common use wherever the palm occurs. Hamilton and Murphy (1988) studied the general use and management of nipa over its broad range and Fong (1992) has done field studies on nipa management in Peninsular Malaysia and tapping in Sarawak (Fong, 1989). *Nypa* appears to have some industrial use as well, as evidenced by research showing that an extract from the leaves inhibits zinc corrosion (Orubite-Okorosaye and Ofokra, 2004).

***Salacca zalacca***. The salak palm is a forest undergrowth species primarily important for its edible fruit, which is obtained from wild and cultivated plants. As indicated in Table 4-4, several other species also have edible fruits, but fruit from *S. zalacca* is the largest and sweetest. Salak fruit is very popular in Indonesia where it is consumed fresh and is canned for domestic and export markets. According to Moge (1991) 15 local trade names exist for salak fruits based upon quality and fruit characteristics. In Thailand, clones of what is believed to be *S. wallichiana* are under cultivation (Yaacob and Subhadrabandu, 1995). Ashari (2002) provides excellent information on the agronomy and botany of salak. The preceding references provide detailed information on cultivating salak which is recommended for home gardens. A new study has shown that salak fruits have antioxidant properties, which could be a boon to promoting the fruit (Aralas, *et al.*, 2009).

As for the remaining palms in Table 4-4 the use pattern is similar to that of Table 4-3 in that food and non-food items have about equal weight. *Eugeissona utilis* is what might be termed a minor multipurpose palm as indicated by the variety of uses listed in Table 4-4. However,

they represent predominantly subsistence uses by indigenous peoples who sometimes (in Sarawak) plant the palm near their houses.

In addition to being used for thatching and to weave a variety of products, certain fan palm leaves provide cheap food-wrapping material. *Licuala peltata*, one form of which has undivided leaves, and *Livistona rotundifolia*, with shallowly-divided leaves, are good examples. Almost everywhere that palm leaves are cut from wild plants, for whatever end use, there is a tendency to harvest an excessive number of leaves per plant, in large part to minimize walking distances.

The effect of leaf harvest of *Livistona rotundifolia* was the subject of a study in North Sulawesi, Indonesia. The study confirms assumptions about the adverse impact of over-harvesting of leaves. Research results showed that leaves on harvested plants grew faster but reached a smaller final leaf size than on unharvested plants. A census of harvested and unharvested palm populations showed that palm density was twice as high and there were ten times as many reproductive-sized palms in unharvested areas (O'Brien and Kinnaird, 1996).

Together the four members of the genus *Phoenix* in Table 4-4 occur widely in Southeast Asia and are common sources of food and non-food subsistence items. These palms persist in many areas because they are adapted to disturbed habitats, can grow on drier sites with poor soils and produce basal suckers which are a major factor in their natural regeneration.

The wanga palm (*Pigafetta filaris*) is a somewhat unusual palm in that it is a pioneer species which colonizes disturbed habitats where it is native in Indonesia and Papua New Guinea. Although its chief economic value is a source of stem wood for construction and to make furniture (Rotinsulu, 2001), *P. filaris* is also esteemed as an elegant ornamental palm. Davis and Kuswara (1987) studied the biology of this palm in Indonesia.

*Trachycarpus fortunei* is well known as an ornamental palm grown in the middle latitudes because of its cold tolerance. The palm also turns out to be a drug source in China as well as the origin of several other products (Essig and Dong, 1987).

As more information becomes known about the use of palms in southern China (and the former Indochina), other examples can be expected to be added to any future list of economic palms.

## **Asian Rattans**

Rattans are first and foremost important as commercial and subsistence sources of cane, the rattan stem. The stem, after stripping off its leaf sheaths, provides the raw material for the cane furniture industry. Depending on the species, the diameter of canes is from about 3 mm to 60 mm or more. In the rattan industry, canes are graded on the basis of seven basic factors: diameter, length of cane, color, hardness, defects and blemishes, length of nodes and uniformity of thickness (UNIDO, 1983).

Another way to characterize rattans is based solely on their diameter: canes are referred to as "large" if they have a diameter above 18 mm; "small" canes are those below that diameter. Large canes are used whole to make the frames of cane furniture. Whole small canes are also

used as struts in some furniture, but more often they are split and used to weave the chair back (Dransfield, 1988).

Three desirable properties characterize rattan canes. One, they are solid (unlike bamboo which are typically hollow) and hence very strong. Two, by the application of heat, most rattans can be bent into and will hold various shapes without deformation. Three, canes can be lacquered to preserve their natural light color or can also be stained or painted.

In addition to its use in furniture making, split cane furnishes material for handicraft and cottage industries to make baskets, mats, bags, hats, fish traps and a host of other products. Rattans are also employed as cordage for tying and binding. The case study (Chapter 2) of the Iban in Sarawak, Malaysia demonstrates how very useful rattans are to indigenous people.

The rattans of Asia belong to the following nine genera: *Calamus*, *Ceratolobus*, *Daemonorops*, *Korthalsia*, *Myrialepis*, *Plectocomia*, *Plectocomiopsis*, *Pogonotium* and *Retispatha*. Around 533 rattan species have been described, with *Calamus* and *Daemonorops* representing about 90% of the total. These figures include useful and not used canes.

Nearly all rattan canes continue to come from wild plants. However, in the coming years rattan cultivation, along with some form of rattan management, is playing an increasing role in providing sources of raw canes and in turn relieving pressure on threatened wild populations.

Rattan canes represent the palm family's most valuable non-wood forest product. At the same time rattans, as a group, are exceedingly difficult to generalize about because of incomplete data on distribution patterns and conservation status as well as the confusion which exists between local or trade names on the one hand and scientific names on the other.

Following the general approach used for South and Southeast Asia palms, rattans are divided into two groups on the basis of whether they are known to be threatened or not threatened in the wild. Utilization information on these rattans is incomplete, but it was deemed best to include them when there was some doubt, with the assumption that some present or future utility was likely. This approach seemed to be a better alternative than omitting many rattan species altogether.

A rough count shows that three out of four rattans lack information about their conservation status. Dozens of these species are known to have utility as cane sources. In order to include and consider all such rattans, a third group was created consisting of rattans known to be utilized but with an unknown conservation status.

### **Threatened Asian Rattans**

As climbing palms, rattans need trees for support and hence deforestation leads to their destruction. But most rattans can and do survive in areas of timber harvesting or partial land clearing where some tree cover remains. Secondary forest supports rattan growth, but the rattans do not reach their maximum length and diameter, as they do in primary forest.

Cutting wild rattans is a destructive exploitation comparable to felling palms for stem starch, construction wood or palm heart. Exploitation of rattans for commercial and subsistence purposes appears to be a major factor which has placed so many species at risk.

At least 127 rattan species are known to be threatened in the wild and these are presented in Table 4-5 below.

**Table 4-5 Threatened Asian Rattans\***

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus adspersus</i>	?	<i>Indonesia: Java, Sumatra</i>
<i>Calamus andamanicus</i> *	<i>mofabet</i>	<i>India: Andaman Islands (endemic)</i>
<i>Calamus asperimus</i>	<i>rotan leulues</i>	<i>Indonesia: Java</i>
<i>Calamus bacularis</i> *	<i>wi tulang</i>	<i>Malaysia: Sarawak (endemic)</i>
<i>Calamus bicolor</i>	<i>lasi, rasi</i>	<i>Philippines: Mindanao</i>
<i>Calamus brandisii</i>	<i>vanthai</i>	<i>India: Karnataka, Kerala, Tamil Nadu (endemic)</i>
<i>Calamus ceratophorus</i>	<i>ui sông</i>	<i>Vietnam: Phu Khanh</i>
<i>Calamus ciliaris</i> *	<i>hoe cacing</i>	<i>Indonesia: Java, Sumatra</i>
<i>Calamus cockburnii</i>	?	<i>Malaysia: Pahang, Peninsular (endemic)</i>
<i>Calamus conjugatus</i>	<i>wi janggut</i>	<i>Malaysia: Sarawak (endemic)</i>
<i>Calamus corneri</i>	<i>rotan perut ayam</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus crassifolius</i>	<i>wi takong</i>	<i>Malaysia: Sarawak (endemic)</i>
<i>Calamus cumingianus</i> *	<i>douung-douung</i>	<i>Philippines: Luzon</i>

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus delessertianus</i>	<i>ottamoodan</i>	<i>India: Southwest</i>
<i>Calamus delicatulus</i>	<i>nara wel</i>	<i>Sri Lanka (endemic)</i>
<i>Calamus densiflorus</i> *	<i>rotan kerai</i>	<i>Malaysia: Peninsular; Singapore; Thailand</i>
<i>Calamus digitatus</i>	<i>kukulu wel</i>	<i>Sri Lanka (endemic)</i>
<i>Calamus dilaceratus</i>	?	<i>India: Andaman Islands (endemic)</i>
<i>Calamus dimorphacanthus</i> *	<i>lambutan, tandulang-montalban</i>	<i>Philippines: Luzon</i>
<i>Calamus dioicus</i>	<i>rani</i>	<i>Vietnam</i>
<i>Calamus discolor</i> *	<i>halls, kumaboy</i>	<i>Philippines: Luzon</i>
<i>Calamus dongnaiensis</i>	<i>long-tchéou</i>	<i>Thailand; Vietnam: south</i>
<i>Calamus dransfieldii</i>	?	<i>India: Kerala</i>
<i>Calamus endauensis</i>	?	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus filipendulus</i>	<i>rotan batu</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus foxworthyi</i>	?	<i>Philippines: Palawan</i>
<i>Calamus gamblei</i>	<i>pacha chural</i>	<i>India: Southwest</i>
<i>Calamus godefroyi</i>	<i>phdau tuk</i>	<i>Cambodia; Thailand; Vietnam</i>
<i>Calamus grandifolius</i> *	<i>saba-ong</i>	<i>Philippines: Luzon</i>

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus guruba</i>	?	<i>Bangladesh; Bhutan; Cambodia; China; India; Lao; Malaysia: Peninsular; Myanmar; Thailand; Vietnam;</i>
<i>Calamus harmandii</i>	?	<i>Lao; possibly Thailand; Vietnam</i>
<i>Calamus henryamus</i>	<i>than-moï</i>	<i>Vietnam: Ha Bac, Lang Son</i>
<i>Calamus hepburnii</i>	?	<i>Malaysia: Sabah (endemic)</i>
<i>Calamus holttumii</i>	<i>rotan perut ayam</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus hookerianus</i>	<i>velichural</i>	<i>India: Southwest</i>
<i>Calamus hypertrichosus</i>	?	<i>Indonesia: Kalimantan; Malaysia: Sarawak.</i>
<i>Calamus inops*</i>	<i>rotan tohiti</i>	<i>Indonesia: Sulawesi</i>
<i>Calamus jenningsianus</i>	<i>lagipi</i>	<i>Philippines: Mindoro</i>
<i>Calamus karuensis</i>	<i>rotan penjalin rawa</i>	<i>Indonesia: Sumatra</i>
<i>Calamus kjellbergii</i>	?	<i>Indonesia: Sulawesi</i>
<i>Calamus koordersianus*</i>	<i>rotan boga</i>	<i>Indonesia: Sulawesi</i>
<i>Calamus laevigatus</i> <i>var. serpentinus*</i>	<i>rotan tunggal</i>	<i>Malaysia: Sabah (endemic)</i>
<i>Calamus laxissimus</i>	?	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus longispathus*</i>	<i>rotan kunyung</i>	<i>Malaysia: Peninsular (endemic)</i>



<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus manan</i> #	<i>rotan manau</i>	<i>Borneo; Malaysia: Peninsular; Indonesia: Sumatra; Thailand</i>
<i>Calamus megaphyllus</i> *	<i>banakbo</i>	<i>Philippines: Leyte</i>
<i>Calamus melanoloma</i>	<i>rotan gelengdage</i>	<i>Indonesia: Java</i>
<i>Calamus melanorhynchus</i> *	<i>dalimban</i>	<i>Philippines: Mindanao</i>
<i>Calamus merrillii</i> #	<i>palasan</i>	<i>Philippines: Luzon</i>
<i>Calamus metzianus</i>	<i>ela wewel</i>	<i>India: Southwest; Sri Lanka</i>
<i>Calamus minahassae</i> *	<i>datu</i>	<i>Indonesia: Sulawesi</i>
<i>Calamus minutus</i>	?	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus mitis</i> *	<i>matkong</i>	<i>Philippines: Babuyan, Batanes</i>
<i>Calamus moorhousei</i>	?	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus moseleyanus</i> *	<i>sarani</i>	<i>Philippines: Basilan, Malanipa</i>
<i>Calamus multinervis</i> *	<i>balala</i>	<i>Philippines: Mindanao</i>
<i>Calamus nagbettai</i>	<i>nag betta</i>	<i>India: Southwest</i>
<i>Calamus nicobaricus</i>	<i>tchye</i>	<i>India: Great Nicobar Island (endemic)</i>
<i>Calamus nielsenii</i>	?	<i>Malaysia: Sarawak (endemic)</i>
<i>Calamus ovoideus</i> #	<i>thudarena</i>	<i>Sri Lanka (endemic)</i>
<i>Calamus pachystemonus</i>	<i>kukulu wel</i>	<i>Sri Lanka (endemic)</i>

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus padangensis</i>	?	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus palustris</i>	<i>rong</i>	<i>Cambodia; India: Anadaman Islands; Lao; Malaysia: Peninsular; Thailand; Vietnam</i>
<i>Calamus penicillatus</i>	<i>rotan batu</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus poensis</i>	?	<i>Malaysia: Sarawak (endemic)</i>
<i>Calamus poilanei</i>	<i>u pôn</i>	<i>Lao; Thailand; Vietnam: Lam Dong, Phu Khanh</i>
<i>Calamus pycnocarpus</i>	<i>rotan kong</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus radiatus</i>	<i>kukulu wel</i>	<i>Sri Lanka (endemic)</i>
<i>Calamus radulosus</i>	?	<i>Malaysia: Peninsular; Thailand</i>
<i>Calamus rhabdocladus</i>	<i>r'sui</i>	<i>China; Vietnam: Dong Nai, Lam Dong, Phu Khanh; Lao</i>
<i>Calamus ridleyanus</i>	<i>rotan kerai</i>	<i>Malaysia: Peninsular; Singapore (endemic to Malay Peninsula)</i>
<i>Calamus robinsonianus</i>	?	<i>Indonesia: Moluccas</i>
<i>Calamus rotang</i>	<i>cheruchural</i>	<i>India: Southern; Sri Lanka</i>
<i>Calamus scortechinii</i> *	<i>rotan demuk</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus sedens</i> *	<i>rotan dudok</i>	<i>Malaysia: Peninsular; Thailand</i>
<i>Calamus semoi</i> *	<i>wi tut</i>	<i>Malaysia: Sarawak (endemic)</i>
<i>Calamus senalingensis</i>	?	<i>Malaysia: Peninsular (endemic)</i>

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus setulosus</i>	<i>rotan kerai</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus simplex</i> *	<i>rotan kerai gunung</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus spectabilis</i>	<i>ombol</i>	<i>Indonesia: Java, Sumatra</i>
<i>Calamus spectatissimus</i>	<i>rotan semut</i>	<i>Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular; Thailand</i>
<i>Calamus symphysipus</i> *	<i>rotan umbol</i>	<i>Indonesia: Sulawesi; Philippines: Bucas Grande, Catanduanes</i>
<i>Calamus tanakadatei</i>	<i>rotan tekok</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus thwaitesii</i>	<i>pannichural</i>	<i>India: Southwest; Sri Lanka</i>
<i>Calamus thysanolepis</i>	<i>cây mai</i>	<i>China; Vietnam: Thanh Hoa</i>
<i>Calamus trispermus</i> *	?	<i>Philippines: Luzon</i>
<i>Calamus usitatus</i>	?	<i>Philippines: Nueva Vizcaya; Pangasi</i>
<i>Calamus vattayila</i>	<i>vattayila</i>	<i>India: Southwest</i>
<i>Calamus vidalianus</i> *	<i>yantok</i>	<i>Philippines: Luzon</i>
<i>Calamus vinosus</i>	<i>yaming</i>	<i>Philippines: Mindanao</i>
<i>Calamus walkeri</i>	<i>may dang</i>	<i>China; Vietnam</i>
<i>Calamus warburgii</i> *	?	<i>Papua New Guinea</i>
<i>Calamus whitmorei</i>	?	<i>Malaysia: Peninsular (endemic)</i>
<i>Calamus wightii</i>	<i>soojibetha</i>	<i>India: Tamil Nadu (endemic)</i>

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus zeylanicus</i>	<i>thambotu wel</i>	<i>Sri Lanka (endemic)</i>
<i>Ceratolobus glaucescens</i>	<i>rotan beula</i>	<i>Indonesia: Java</i>
<i>Ceratolobus kingianus</i>	<i>rotan jere landak</i>	<i>Malaysia: Peninsular (endemic)</i>
<i>Ceratolobus pseudoconcolor</i>	<i>rotan omas</i>	<i>Indonesia: Java, Sumatra</i>
<i>Daemonorops acampostachys</i>	<i>daun wi, rotan dudok</i>	<i>Malaysia: Sabah, Sarawak; Indonesia: Kalimantan</i>
<i>Daemonorops affinis</i>	<i>bag-bag</i>	<i>Philippines: Mindanao</i>
<i>Daemonorops clemensiana</i> *	?	<i>Philippines: Mindanao</i>
<i>Daemonorops curranii</i> *	<i>pitpit</i>	<i>Philippines: Palawan</i>
<i>Daemonorops leptopus</i> *	<i>rotan bacap</i>	<i>Malaysia: Peninsular; Singapore; Thailand</i>
<i>Daemonorops loheriana</i>	?	<i>Philippines: Luzon</i>
<i>Daemonorops longispatha</i> *	<i>wi tibu</i>	<i>Borneo</i>
<i>Daemonorops macrophylla</i>	<i>rotan cincin</i>	<i>Malaysia: Peninsular; Thailand</i>
<i>Daemonorops margaritae</i> var. <i>palawanica</i>	<i>ka-api</i>	<i>Philippines: Palawan</i>
<i>Daemonorops oblonga</i>	<i>song mat</i>	<i>Vietnam</i>

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Daemonorops oligophylla</i>	?	Malaysia: Peninsular (endemic)
<i>Daemonorops pannosa</i>	sabilog	Philippines: Leyte
<i>Daemonorops sepal</i>	rotan getah gunung	Malaysia: Peninsular; Thailand
<i>Daemonorops unijuga</i>	?	Malaysia: Sarawak (endemic)
<i>Daemonorops urdanetana</i>	sahaan	Philippines: Mindanao
<i>Korthalsia junghuhnii</i>	rotan bulu	Indonesia: Java
<i>Korthalsia lanceolata</i>	rotan dahan	Malaysia: Peninsular (endemic)
<i>Korthalsia merrillii</i>	?	Philippines: Palawan (endemic)
<i>Korthalsia rogersii</i>	?	India: Andaman Islands (endemic)
<i>Korthalsia tenuissima</i>	rotan daha tikus	Malaysia: Peninsular (endemic)
<i>Plectocomia billitonensis</i>	?	Indonesia: Belitung Island; Sumatra
<i>Plectocomia dransfieldiana</i>	rotan mantang ilang	Malaysia: Peninsular (endemic)
<i>Plectocomia elmeri</i>	binting dalaga	Philippines: Mindanao, Mt. Apo
<i>Plectocomia longistigma</i>	?	Indonesia: Java, east
<i>Plectocomia lorzingii</i>	?	Indonesia: Sibolangit, Sumatra
<i>Plectocomia pygmaea</i>	?	Indonesia: Kalimantan, Pontianak, Sei Poetat

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>
<i>Plectocomiopsis wrayi</i>	<i>rotan pepe</i>	<i>Malaysia: Peninsular; Thailand</i>
<i>Pogonotium moorei</i>	?	<i>Malaysia: Gunung Gaharu, Sarawak (endemic)</i>
<i>Pogonotium ursinum</i>	<i>rotan bulu</i>	<i>Brunei; Malaysia: Peninsular, Sarawak</i>

Notes:

\* See also Table under Chapter 13.

1. Other local names are given in some of the sources cited.

2. Distribution is within the Asian region as defined; some species also occur elsewhere.

# Major commercial species, as defined by Dransfield & Manokaran, 1993.

\* Minor commercial species, as defined by Dransfield & Manokaran, 1993.

General sources: Alam, 1990; Amatya, 1997; Avé, 1988; Basu, 1992; Boonsermsuk et al., 2007; De Zoysa & Vivekanandan, 1994; Dransfield, 1979, 1982, 1984, 1992, 1997; Dransfield & Manokaran, 1993; Evans et al., 2001; Gagnepain, 1937; Guzman & Fernando, 1986; Henderson, 2009; Hodel, 1998; Johnson, 1991b; Khou, 2008; Kurz, 1874; Lakshmana, 1993; Liao, 1994; Madulid, 1981; Mathew et al., 2007; Pearce, 1994; Peters et al., 2007; Rattan Information Centre Bulletin, various issues; Renuka, 1992, 1995; Renuka & Bhat, 2002; Siebert, 1989.

### Non-threatened Asian Rattans

On the basis of current knowledge, only 24 Asian rattans are not under threat from exploitation and deforestation. Table 4-6 identifies these species. Why these rattans are not threatened is unclear. The answer probably lies in some combination of factors such as their greater natural populations, in some cases broader geographic ranges, adaptability to forest disturbance and the clustering grown form which characterizes about three-fourths of the species listed.

**Table 4-6** *Non-threatened Asian Rattans*

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus burckianus</i> *	<i>howe belukbuk</i>	<i>Indonesia: Java</i>
<i>Calamus exilis</i> #	<i>rotang gunung</i>	<i>Indonesia: Sumatra; Malaysia: Peninsular; Thailand</i>
<i>Calamus formosanus</i>	<i>(Formosan cane)</i>	<i>Taiwan</i>
<i>Calamus gregisectus</i>	?	<i>Myanmar</i>
<i>Calamus heteroideus</i> *	<i>howe cacing</i>	<i>Indonesia: Java, Sumatra</i>
<i>Calamus javensis</i> #	<i>rotan opot</i>	<i>Brunei; Indonesia: Kalimantan, Java, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Philippines: Palawan; Singapore; Thailand</i>
<i>Calamus pseudotenius</i>	<i>perumperambu</i>	<i>India: Deccan Peninsula, Western Ghats; Sri Lanka</i>
<i>Calamus reinwardtii</i>	<i>rotan dedek</i>	<i>Indonesia: Java (endemic)</i>
<i>Calamus trachycoleus</i> #	<i>rotan itit</i>	<i>Indonesia: Kalimantan</i>
<i>Daemonorops calicarpa</i> *	<i>lumpit</i>	<i>Indonesia: Sumatra; Malaysia: Peninsular</i>
<i>Daemonorops crinita</i> *	?	<i>Indonesia: Sumatra, Kalimantan</i>

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Daemonorops didymophylla</i> *	<i>rotan tunggal</i>	<i>Brunei; Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah; Sarawak; Singapore; Thailand</i>
<i>Daemonorops fissa</i> *	<i>rotan kotok</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Sabah; Sarawak</i>
<i>Daemonorops grandis</i> *	<i>rotan sendang</i>	<i>Malaysia: Peninsular; Singapore; Thailand</i>
<i>Daemonorops macroptera</i>	?	<i>Indonesia: Sulawesi</i>
<i>Daemonorops oblonga</i> *	<i>rotan pitik</i>	<i>Indonesia: Java</i>
<i>Daemonorops rubra</i> *	<i>teretes</i>	<i>Indonesia: Java</i>
<i>Korthalsia echinometra</i> #	<i>uwi hurang</i>	<i>Brunei; Cambodia; Indonesia: Kalimantan, Sumatra; Lao; Malaysia: Peninsular, Sabah, Sarawak; Singapore</i>
<i>Korthalsia laciniosa</i> #	<i>rotan dahan</i>	<i>India: Andaman &amp; Nicobar Islands; Indonesia: Java, Sumatra; Lao; Malaysia: Peninsular; Myanmar; Philippines; Singapore; Thailand; Vietnam</i>
<i>Korthalsia zippelii</i>	<i>inuwai</i>	<i>Indonesia: Papua</i>



Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>
<i>Myrialepis paradoxa</i> *	<i>rotan kertong</i>	<i>Cambodia; Indonesia: Sumatra; Malaysia: Peninsular; Lao; Myanmar; Singapore; Thailand; Vietnam</i>
<i>Plectocomia elongata</i> <i>var. elongata</i>	<i>wi</i>	<i>Brunei; Cambodia; Indonesia: Java, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Thailand; Vietnam</i>
<i>Plectocomia mulleri</i>	<i>rotan tibu</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Peninsular, Sabah, Sarawak</i>
<i>Plectocomiopsis geminiflora</i> *	<i>ialis, rotan pa</i>	<i>Brunei; Cambodia; Indonesia: Kalimantan, Sumatra; Lao; Malaysia: Peninsular, Sabah, Sarawak; Myanmar; Thailand; Vietnam</i>

Notes: 1. Other local names are given in some of the sources cited.

2. Distribution is within the Asian region as defined; some species also occur elsewhere.

# Major commercial species, as defined by Dransfield & Manokaran, 1993.

\* Minor commercial species, as defined by Dransfield & Manokaran, 1993.

Sources: Same as Table 4-5.

### Asian Rattans with Unknown Conservation Status

Dransfield and Manokaran (1993) documented utilization of 135 rattan species (30 major and 105 minor). Table 4-5 and Table 4-6 account for some but not all of that total. The remaining species from that study, which lack information about their conservation status, are included in Table 4-7, along with additional species from later published sources. That we know nothing about the in situ status of the 105 rattans in Table 4-7 is alarming.

**Table 4-7 Asian Rattans with Unknown Conservation Status and Reported Uses**

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>
<i>Calamus acanthophyllus</i>	wai tia	Cambodia; Lao; Nepal; Thailand
<i>Calamus acanthospathus</i>	Wai hom	Bhutan; China: Yunnan; India: Northeast; Lao; Myanmar; Nepal; Tibet
<i>Calamus albus</i> *	rotan putih	Indonesia: Moluccas, Papua
<i>Calamus amplijugus</i>	?	Brunei; Malaysia: Sabah, Sarawak
<i>Calamus aruensis</i> *	?	Indonesia: Moluccas
<i>Calamus arugda</i> *	arugda	Philippines: Cagayan, Luzon
<i>Calamus axillaris</i> *	rotan sega air	Brunei; Indonesia: Sumatra; Malaysia: Peninsular, Sarawak; Thailand
<i>Calamus bimaniferus</i>	wai noi	Lao
<i>Calamus blumei</i> *	rotan tukas	Brunei; Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Thailand
<i>Calamus boniensis</i> *	tomani	Indonesia: Sulawesi (endemic ?)
<i>Calamus caesius</i> #	rotan sega	Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Philippines: Palawan; Thailand
<i>Calamus castaneus</i> *	rotan cucor	Indonesia: Sumatra; Malaysia: Peninsular; Thailand
<i>Calamus conirostris</i> *	rotan dago kancil	Brunei; Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak
<i>Calamus didymocarpus</i> *	nue waatang	Malaysia: Sulawesi (endemic ?)

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>
<i>Calamus diepenhorstii</i> *	rotan batu	Brunei; Indonesia: Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Philippines: Palawan; Singapore; Thailand
<i>Calamus dimorphacanthus</i> var. <i>halconensis</i> *	lambutan	Philippines: Laguna, Mindoro
<i>Calamus egregius</i> #	duanye shengteng	China: Hainan Island (endemic)
<i>Calamus elmerianus</i> *	sababai	Philippines: Agusan, Davao, Dinagat, Tayabas
<i>Calamus erinaceus</i>	phdao aeng	Borneo; Cambodia; Indonesia: Sumatra; Malaysia: Peninsular; Philippines; Singapore; Thailand
<i>Calamus erioacanthus</i> *	wi buluh	Malaysia: Sarawak (endemic)
<i>Calamus flabellatus</i> *	rotan lilin	Brunei; Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak
<i>Calamus floribundus</i>	chota bet	Bangladesh; India: Northeast; Myanmar
<i>Calamus gibbsianus</i> *	silau-silau	Malaysia: Sabah, Sarawak
<i>Calamus gracilis</i>	mapuri bet	Bangladesh; China: Yunnan; India: Northeast; Lao; Myanmar
<i>Calamus hispidulus</i> *	rotan bulu	Indonesia: Kalimantan; Malaysia: Sarawak
<i>Calamus hollrungii</i> *	uawa jawa	Indonesia: Papua
<i>Calamus insignis</i> *	rotan batu	Indonesia: Sumatra; Malaysia: Peninsular; Singapore; Thailand
<i>Calamus javensis</i>	uwai peladas	Borneo; Brunei; Indonesia: Java, Sumatra; Malaysia: Peninsular; Philippines: Palawan; Thailand

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>
<i>Calamus laevigatus</i> * var. <i>laevigatus</i> and var. <i>mucronatus</i>	<i>rotan tunggal</i>	<i>Brunei; Indonesia: Kalimantan, Sumatra;</i> <i>Malaysia: Peninsular, Sabah, Sarawak;</i> <i>Singapore; Thailand</i>
<i>Calamus leiocaulis</i> *	<i>rotan jermasi</i>	<i>Indonesia: Sulawesi (endemic ?)</i>
<i>Calamus leptospadix</i>	<i>dhangre bet</i>	<i>Bangladesh; Bhutan; India: Northeast;</i> <i>Myanmar; Nepal</i>
<i>Calamus leptostachys</i> *	<i>ronti</i>	<i>Indonesia: Sulawesi (endemic ?)</i>
<i>Calamus longisetus</i> *	<i>leme</i>	<i>Malaysia: Peninsular; Myanmar; Thailand;</i>
<i>Calamus luridus</i> *	<i>huwi pantis</i>	<i>Indonesia: Sumatra; Malaysia: Peninsular;</i> <i>Thailand</i>
<i>Calamus manillensis</i> *	<i>bayabong</i>	<i>Philippines: Agusan, Davao, Dinagat, Nueva</i> <i>Viscaya, Sorsogon, Surigao, Tayabas,</i>
<i>Calamus marginatus</i> *	<i>rotan besi</i>	<i>Brunei; Indonesia: Kalimantan, Sumatra;</i> <i>Malaysia: Sabah, Sarawak; Philippines:</i> <i>Palawan</i>
<i>Calamus mattanensis</i> *	<i>rotan maran</i>	<i>Indonesia: Kalimantan; Malaysia: Sarawak</i>
<i>Calamus microcarpus</i> *	<i>kalapit</i>	<i>Philippines: Agusan, Camarines, Davao,</i> <i>Laguna, Lanao, Rizal, Sorsogon; Tayabas</i>
<i>Calamus microsphaerion</i> *	<i>kulakling</i>	<i>Malaysia: Sabah; Philippines: Bataan,</i> <i>Culion, Palawan</i>
<i>Calamus mindorensis</i> #	<i>tumalim</i>	<i>Philippines: Luzon, Mindanao</i>
<i>Calamus muricatus</i> *	<i>rotan melukut</i>	<i>Brunei; Indonesia: Kalimantan, Sumatra;</i> <i>Malaysia: Sabah, Sarawak;</i>

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus myriacanthus</i> *	<i>wi dudok</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Sarawak;</i>
<i>Calamus nambariensis</i>	<i>korak bet</i>	<i>Bangladesh; Bhutan; China: Yunnan ; India: Northeast; Lao; Myanmar; Nepal; Thailand; Vietnam</i>
<i>Calamus optimus</i> #	<i>rotan taman</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Sabah, Sarawak</i>
<i>Calamus ornatus</i> #	<i>rotan kesup</i>	<i>Brunei; Indonesia: Java, Sulawesi, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Philippines; Singapore; Thailand</i>
<i>Calamus oxleyanus</i> *	<i>manau riang</i>	<i>Brunei; Indonesia: Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Singapore; Thailand</i>
<i>Calamus palustris</i> #	<i>rotan buku hitam</i>	<i>China; India: Nicobar and Andaman Islands; Lao; Malaysia: Peninsular; Myanmar; Thailand; Vietnam</i>
<i>Calamus paspalanthus</i> *	<i>rotan sirikis</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Peninsular, Sabah, Sarawak</i>
<i>Calamus pedicellatus</i> *	<i>samole</i>	<i>Indonesia: Sulawesi (endemic)</i>
<i>Calamus perakensis</i> *	<i>rotan dudok</i>	<i>Indonesia: Sumatra; Malaysia: Peninsular</i>
<i>Calamus peregrinus</i> *	<i>nguyay</i>	<i>Malaysia: Peninsular; Thailand</i>
<i>Calamus pilosellus</i> *	<i>rotan lintang</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Sabah, Sarawak (endemic to Borneo)</i>
<i>Calamus pogonacanthus</i> #	<i>wi tut</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Sabah, Sarawak (endemic to Borneo)</i>
<i>Calamus polystachys</i> *	<i>wai lau cincin</i>	<i>Indonesia: Java, Sumatra; Malaysia: Peninsular</i>

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>
<i>Calamus ramulosus</i> *	<i>panlis</i>	<i>Philippines: Luzon (endemic)</i>
<i>Calamus reyesianus</i> *	<i>apas</i>	<i>Philippines: Laguna, Quezon, Tayabas</i>
<i>Calamus rhomboideus</i> *	<i>rotan dawuh</i>	<i>Indonesia: Java, Sumatra</i>
<i>Calamus rhytidomus</i> *	?	<i>Indonesia: Kalimantan</i>
<i>Calamus rudentum</i>	<i>wai boun</i>	<i>Cambodia; Lao; Myanmar; Thailand; Vietnam</i>
<i>Calamus ruvidus</i> *	<i>wee lumbak</i>	<i>Malaysia: Sarawak (endemic)</i>
<i>Calamus salcifolius</i>	<i>lpeak</i>	<i>Cambodia, Vietnam</i>
<i>Calamus scabridulus</i> *	<i>dara panda</i>	<i>Indonesia: Sumatra; Malaysia: Peninsular</i>
<i>Calamus scipionum</i> #	<i>rotan semambu</i>	<i>Brunei; Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Philippines: Palawan; Singapore; Thailand</i>
<i>Calamus siamensis</i>	<i>wai khom</i>	<i>Cambodia; Lao; Malaysia: Peninsular; Thailand</i>
<i>Calamus simplicifolius</i> #	<i>danye shengteng</i>	<i>China: Hainan Island</i>
<i>Calamus siphonospathus</i> *	<i>talola</i>	<i>Indonesia: Sulawesi; Philippines: Luzon, Mindanao</i>
<i>Calamus solitarius</i>	<i>wai thork</i>	<i>Lao; Thailand</i>
<i>Calamus spinifolius</i> *	<i>kurakling</i>	<i>Philippines: Luzon</i>
<i>Calamus subinermis</i> #	<i>rotan batu</i>	<i>Indonesia: Sulawesi; Malaysia: Sabah; Philippines: Palawan</i>

<b>Scientific Names</b>	<b>Selected Local Names<sup>1</sup></b>	<b>Distribution<sup>2</sup></b>
<i>Calamus tenuis</i>	<i>bet</i>	<i>Widespread South and Southeast Asia</i>
<i>Calamus tetradactylus</i> #	<i>baiteng (white rattan)</i>	<i>Cambodia; China: Hainan Island , South; Lao; Thailand; Vietnam</i>
<i>Calamus tomentosus</i> *	<i>rotan tukas</i>	<i>Borneo; Malaysia: Peninsular</i>
<i>Calamus tumidus</i> #	<i>rotan manau tikus</i>	<i>Indonesia: Sumatra; Malaysia: Peninsular</i>
<i>Calamus ulur</i> *	<i>?</i>	<i>Indonesia: Sumatra; Malaysia: Peninsular</i>
<i>Calamus unifarius</i> *	<i>wai sidekeni</i>	<i>India: Nicobar Islands; Indonesia: Java, Sumatra</i>
<i>Calamus usitatus</i> *	<i>babuyan</i>	<i>Malaysia: Sabah; Philippines</i>
<i>Calamus viminalis</i> *	<i>penjalin cacing</i>	<i>Bangladesh; Cambodia; India: Andaman Islands, Bihar, Maharastra, Orissa, Prasesh; West Bengal; Indonesia: Bali, Java, Sumatra; Lao; Malaysia: Peninsular; Myanmar; Sikkim; Thailand</i>
<i>Calamus wailong</i> #	<i>wailong</i>	<i>China: Yunnan; Lao</i>
<i>Calamus zollingeri</i> #	<i>rotan batang</i>	<i>Indonesia: Moluccas, Sulawesi</i>
<i>Daemonorops angustifolia</i> *	<i>rotan getah</i>	<i>Malaysia: Peninsular; Thailand</i>
<i>Daemonorops draco</i> *	<i>rotan jernang</i>	<i>Indonesia: Kalimantan, Riau Archipelago, Sumatra; Malaysia: Sarawak</i>
<i>Daemonorops elongata</i> *	<i>lempinin pahetan</i>	<i>Indonesia: Kalimantan; Malaysia: Sabah (endemic to Borneo)</i>
<i>Daemonorops formicaria</i>	<i>uwai singkurung</i>	<i>Brunei; Malaysia: Sarawak</i>

Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>
<i>Daemonorops hirsuta</i> *	<i>rotan sepet</i>	<i>Indonesia: Sumatra; Malaysia: Peninsular, Sarawak; Singapore</i>
<i>Daemonorops ingens</i> *	<i>keplar</i>	<i>Brunei; Malaysia: Sabah, Sarawak; Indonesia: Kalimantan (endemic to Borneo)</i>
<i>Daemonorops jenkinsiana</i>	<i>may rut</i>	<i>Bangladesh; Bhutan; Cambodia; China; India: Northeast; Lao; Myanmar; Thailand; Vietnam</i>
<i>Daemonorops lamprolepis</i> *	<i>lapa</i>	<i>Indonesia: Sulawesi (endemic ?)</i>
<i>Daemonorops margaritae</i> var. <i>margaritae</i> #	<i>huangteng</i>	<i>China: Hainan Island, South</i>
<i>Daemonorops melanochaetes</i> *	<i>sekei udang</i>	<i>Indonesia: Java, Sumatra; Malaysia: Peninsular</i>
<i>Daemonorops micracantha</i> *	<i>rotan jernang</i>	<i>Indonesia: Kalimantan; Malaysia: Peninsular, Sabah, Sarawak</i>
<i>Daemonorops ochrolepis</i> *	<i>ditaan</i>	<i>Philippines: Leyte</i>
<i>Daemonorops oxycarpa</i>	<i>uwai bintango</i>	<i>Borneo; Brunei</i>
<i>Daemonorops periacantha</i> *	<i>wi empunoh</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Peninsular, Sabah, Sarawak; Singapore</i>
<i>Daemonorops robusta</i> #	<i>rotan susu</i>	<i>Indonesia: Moluccas, Sulawesi</i>
<i>Daemonorops rutilis</i> *	<i>widudok</i>	<i>Brunei; Malaysia: Sabah, Sarawak</i>
<i>Daemonorops sabut</i> #	<i>jungan</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Peninsular, Sabah, Sarawak; Singapore; Thailand</i>



Scientific Names	Selected Local Names <sup>1</sup>	Distribution <sup>2</sup>
<i>Daemonorops scapigera</i> *	<i>wi empunok ruai</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Peninsular, Sabah, Sarawak</i>
<i>Daemonorops sparsiflora</i> *	<i>wi ruah air</i>	<i>Brunei; Indonesia: Kalimantan; Malaysia: Sabah, Sarawak (endemic to Borneo)</i>
<i>Korthalsia cheb</i> #	<i>keb</i>	<i>Indonesia: Kalimantan; Malaysia: Sabah, Sarawak</i>
<i>Korthalsia ferox</i>	<i>uwai selika</i>	<i>Borneo; Brunei; Thailand</i>
<i>Korthalsia flagellaris</i> #	<i>rotan dahan</i>	<i>Brunei; Indonesia: Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Singapore; Thailand</i>
<i>Korthalsia jala</i>	<i>wi danan</i>	<i>Brunei; Malaysia: Sabah, Sarawak</i>
<i>Korthalsia rigida</i> #	<i>rotan dahan</i>	<i>Brunei; Indonesia: Kalimantan, Sumatra Malaysia: Peninsular, Sabah, Sarawak; Philippines: Palawan; Thailand</i>
<i>Korthalsia robusta</i> #	<i>rotan asas</i>	<i>Brunei; Indonesia: Kalimantan, Sumatra Malaysia: Peninsular, Sabah, Sarawak; Philippines: Palawan</i>
<i>Korthalsia rostrata</i> #	<i>rotan semut</i>	<i>Brunei; Indonesia: Kalimantan, Sumatra; Malaysia: Peninsular, Sabah, Sarawak; Singapore; Singapore; Thailand</i>

Notes: 1. Other local names are given in some of the sources cited.

2. Distribution is within the Asian region as defined;

some species also occur elsewhere.

# Major commercial species, as defined by Dransfield & Manokaran, 1993.

\* Minor commercial species, as defined by Dransfield & Manokaran, 1993.

Sources: Same as Table 4-5.

## Discussion

A detailed discussion of rattan canes and their commercial and subsistence uses is beyond the scope of the present study. However, two objectives may be undertaken: first, to draw

attention to the major sources of technical information on rattans and their products and second, to examine other selected issues related to the exploitation of wild rattans.

### **Technical Information on Rattans**

There has been an impressive outpouring of technical studies on rattans over the past decade and a half. Rattans have easily received more attention than all other wild palm products combined, a clear indication of their economic value.

Modern rattan development was initiated in 1975 with a rattan project in Peninsular Malaysia. Four years later, the first rattan workshop was held in Singapore (IDRC, 1980) sponsored by the International Development Research Centre (IDRC) of Canada. Also the first regional rattan study, of Peninsular Malaysia, was published (Dransfield, 1979). Since then, about forty publications have appeared (Table 4-8). Workshop proceedings, regional rattan studies and studies of specific topics have generated much-needed information in three major subject areas: taxonomy, distribution and ecology of wild rattans; domestication and plantation growth of promising species; and industrial processing of canes. Two lengthy rattan bibliographies are included among the publications in Table 4-8.

Rattan research is actively being carried on in the major sources of commercial rattans in South, Southeast and East Asian countries. A library of technical information on all aspects of rattans is housed at the Rattan Information Centre, Forest Research Institute Malaysia, Kepong. The Centre published a bulletin from 1982 to 1993 (see Chapter 11).

In an effort to promote collaborative rattan research, the International Network for Bamboo and Rattan (INBAR) was established formally in 1993. The headquarters were located initially in New Delhi, but moved to Beijing four years later. INBAR is directing its activities toward five subject areas: socio-economic research; information, training and technology transfer; production research; post-harvest technology and utilization; and biodiversity and genetic conservation. INBAR publishes a quarterly newsletter (see Chapter 11) as well as a series of working papers and technical reports, focused on socioeconomics, cultivation, nursery techniques, processing and training. INBAR also supports a database of technical information on bamboo and rattan.

**Table 4-8 Selected Publications on Rattan Since 1979**

<b>Abbreviated Title and Reference</b>	<b>Geographic Coverage</b>	<b>Contents/Comments</b>
<i>Rattans. PROSEA 6 (Dransfield &amp; Manokaran, 1993) Bibliography (Wuljarni-Soitjpto &amp; Danimihardja, 1995).</i>	Australia ; Brunei, Cambodia, China, Indonesia, Lao, Malaysia, Myanmar, Papua New Guinea, Philippines, Singapore, Thailand, Vietnam,	<i>Introduction to rattans of region; 30 major spp. covered in detail; brief descriptions of 105 minor spp. Excellent general information source. Bibliography provides localized references on rattans in Southeast Asia.</i>
<i>Rattan Current Research (Dransfield et al., 2002)</i>	World Meeting site: Rome	<i>Expert consultation on rattan development. December 2000. A special issue of Unasylva Vol. 52, 2001/2, No. 205, included some of the information from the consultation.</i>
<i>Rattan Glossary (Johnson &amp; Sunderland, 2004)</i>	World	<i>Terminology relative to rattans in world and Africa.</i>
<i>Rattan Bibliography (Kong-Ong &amp; Manokaran, 1986)</i>	World	<i>All aspects of rattan from 1790 to June 1986.</i>
<i>Rattans of World (George &amp; Sankara Pillae, 2003).</i>	World	<i>Annotated bibliography of 876 citations.</i>
<i>Guide Cultivation Rattan (Wan Razali et al., 1992)</i>	Southeast Asia but with strong focus on Peninsular Malaysia & Borneo	<i>Field guide for growing rattan as commercial crop, includes discussions of economics &amp; processing. Primary source.</i>
<i>Manual Production Rattan Furniture. (UNIDO, 1983)</i>	Asia	<i>Manual of processing, marketing, design, manufacturing, etc.</i>

Abbreviated Title and Reference	Geographic Coverage	Contents/Comments
<i>Rattan Workshop. (IDRC, 1980)</i>	Asia. Meeting site: Singapore	<i>Proceedings 1st regional rattan meeting (1979). Mostly consists of state-of-the art review of rattan at the time</i>
<i>Rattan Seminar. (Wong &amp; Manokaran, 1985)</i>	Asia; country reports on China, India, Indonesia, Malaysia, Philippines & Thailand. Meeting site: Kuala Lumpur, Malaysia	<i>Proceedings 2nd regional rattan meeting (1984). Technical papers (23) on following topics: propagation practices; ecology &amp; silviculture; properties, pests &amp; diseases; processing &amp; utilization, extension &amp; information dissemination. Broad coverage of key issues.</i>
<i>Recent Research on Rattans. (Rao &amp; Vongkalueang, 1989)</i>	Asia. Meeting site: Chiangmai, Thailand	<i>Proceedings 3rd regional rattan meeting (1987). Technical papers (36) on following topics: research; growth &amp; silviculture: biology; processing &amp; utilization; properties &amp; multipurpose uses; economics &amp; production. Benchmark on research.</i>
<i>Rattan Cultivation (Bacilieri &amp; Appanah, 1999)</i>	Southeast Asia. Meeting site: Kuala Lumpur.	<i>Proceedings of 23 papers on conservation, genetic improvement and silviculture; resource inventory, trade and marketing; international agencies in rattan development; and case studies from SE Asia.</i>
<i>Rattan in Thailand (Boonsermsku et al., 2007)</i>	Thailand.	<i>Analysis of sustainable utilization of rattans from plantations.</i>
<i>Rattan Research China (Xu et al., 2000.)</i>	China	<i>Compendium of 19 papers on broad aspects of rattans in China.</i>
<i>Bamboo &amp; Rattan in Tropical China (Zhu Zhaohua, 2001)</i>	China Meeting sites: Hainan and Yunnan.	<i>Workshop proceedings; 7 of 19 papers deal with rattans</i>
<i>Bamboo &amp; Rattan in World (Zehui, 2007)</i>	China; World	<i>Contributions from experts; about 30% of the book is devoted to rattans.</i>

Abbreviated Title and Reference	Geographic Coverage	Contents/Comments
<i>Rattan Management &amp; Utilization. (Chand Basha &amp; Bhat, 1993)</i>	<i>Primarily India; also Malaysia and Sri Lanka. Meeting site: Trichur, Kerala, India</i>	<i>Proceedings of Indian rattan meeting (1992). Technical papers (50) on following topics: area status reports, resource assessment &amp; conservation; production &amp; management; structure, properties &amp; processing; socio-economics &amp; trade.</i>
<i>Third National Rattan Conference (ATI, 1995)</i>	<i>Philippines. Meeting site: Manila.</i>	<i>National rattan meeting (1995). Theme: Strengthening Community Resource Management Through NTFP Enterprise Development. Papers on rattans in general</i>
<i>Rattan Workshop. (PCARRD, 1990)</i>	<i>Philippines. Meeting site: Cebu City, Philippines</i>	<i>National rattan meeting (1988). Technical papers (10) on various aspects Of production, processing &amp; marketing</i>
<i>Rattans - Philippines. (PCARRD, 1985)</i>	<i>Philippines</i>	<i>Summary of information &amp; recommended practices for plantation establishment, management, cane processing &amp; marketing.</i>
<i>Sustainable Rattan Development (ERDB, 2004)</i>	<i>Asia. Meeting site: Manila</i>	<i>Workshop Proceedings consisting of 9 country reports and papers on sustainable management, technology needs, etc.</i>
<i>Rattans - Malay Peninsula. (Dransfield, 1979)</i>	<i>Malaysia &amp; Singapore</i>	<i>Taxonomy of native rattans with good line drawings of 104 spp; natural history; utilization &amp; cultivation; common names.</i>
<i>Rattans - Sabah. Dransfield, 1984)</i>	<i>Sabah, Malaysia</i>	<i>Taxonomy of 79 native rattan spp.</i>

Abbreviated Title and Reference	Geographic Coverage	Contents/Comments
<i>Rattans: Asia Training Workshop</i> (Rao & Rao, 1997)	Asia. Meeting sites: Sarawak, Sabah.	<i>Proceedings of Training Courses cum Workshops: 34 papers equally divided among taxonomy and ecology; and silviculture, conservation, genetic improvement and biotechnology.</i>
<i>Rattans - Brunei</i> (Dransfield, 1997). <i>Rattans Brunei Interactive Key</i> (Kirkup et al., 1999)	Brunei	<i>Taxonomy of 80 species of native rattans.</i>
<i>Rattans - Sarawak.</i> (Dransfield, 1992)	Sarawak, Malaysia	<i>Taxonomy of 105 species of native rattans.</i>
<i>Rattans - Borneo</i> (Dransfield & Patel, 2005).	Borneo	<i>Interactive key on CD Rom</i>
<i>Rattans - Lao</i> (Evans et al., 2001)	Laos	<i>Taxonomy of 51 species of native rattans.</i>
<i>Rattans Cambodia</i> (Khou 2008)	Cambodia	<i>Taxonomy of 18 species of native rattans.</i>
<i>Rattans - Nepal</i> (Amatya, 1997).	Nepal	<i>Descriptions and distribution of 3 native rattans.</i>

Abbreviated Title and Reference	Geographic Coverage	Contents/Comments
<i>Rattans – India (Basu, 1992)</i>	India, including Andaman & Nicobar Islands	Taxonomic study of 48 native rattan spp.
<i>Rattans - Western Ghats. (Renuka, 1992)</i>	Andhra Pradesh, Karnataka, Kerala Tamil Nadu states, India	Taxonomic study of 19 native rattan spp. of South India.
<i>Rattans - South India. (Lakshmana, 1993)</i>	India: Andhra Pradesh, Karnataka, Kerala Tamil Nadu	General study including taxonomy: silviculture; regeneration; pests & diseases; utilization.
<i>South Indian Rattans (Bhat, 1992)</i>	India: Andhra Pradesh, Karnataka, Kerala Tamil Nadu	Structure & properties of 15 native Calamus spp.
<i>Kerala Rattans (Renuka et al., 1987; Renuka &amp; Bhat, 2002)</i>	Kerala State, India	Morphology, anatomy & physical properties of 10 native Calamus spp; commercial rattans.
<i>Rattans - Andaman &amp; Nicobar Islands. (Renuka, 1995)</i>	Andaman & Nicobar Islands, India	Taxonomic study of 18 species of native rattans.
<i>Rattans - Sri Lanka. (De Zoysa &amp; Vivekanandah, 1994)</i>	Sri Lanka	Field guide to 10 species of native rattans.
<i>Bamboo &amp; Rattan - Sri Lanka. (De Zoysa &amp; Vivekanandah, 1991)</i>	Sri Lanka	Detailed study of 8 rattan and 4 bamboo spp. native to & utilized in Sri Lanka.

Abbreviated Title and Reference	Geographic Coverage	Contents/Comments
<i>Rattans - Bangladesh.</i> (Alain, 1990)	Bangladesh	<i>Taxonomic study of 11 spp. of native rattans.</i>
<i>Rattans – Africa</i> (Sunderland, 2007)	Africa	<i>Field guide to 22 native rattans.</i>
<i>Rattan Workshop – Africa</i> (Sunderland & Profizi, 2002)	Africa	<i>Workshop proceedings of 12 papers on wide range of issues.</i>



### Other Uses of Rattan Palms

A discussion of rattan utilization would be incomplete without mention of useful products other than canes. Examples of secondary product uses are summarized in Table 4-9. It should be pointed out that Table 4-9 contains data on only the 258 rattans in Table 4-5, Table 4-6 and Table 4-7. Secondary uses are documented for other rattan species as well, but Table 4-9 captures the essence of noncane uses.

**Table 4-9** *Known Noncane Uses and Products of Rattans Included in Tables 4-5, 4-6 and 4-7*

Product/Use	Genus and Species
fruit eaten	<i>Calamus acanthophyllus</i> ; <i>C. conirostris</i> ; <i>C. dongnaiensis</i> ; <i>C. floribundus</i> ; <i>C. leptospadix</i> ; <i>C. longisetus</i> ; <i>C. manillensis</i> ; <i>C. merrillii</i> ; <i>C. ornatus</i> 1; <i>C. paspalanthus</i> ; <i>C. rhabdocladus</i> ; <i>C. schortechinii</i> ; <i>C. subinermis</i> ; <i>C. thysanolepis</i> ; <i>C. viminalis</i> <i>Daemonorops formicaria</i> ; <i>D. hirsuta</i> ; <i>D. ingens</i> ; <i>D. oxycarpa</i> ; <i>D. periacantha</i> ; <i>D. rutilis</i> ; <i>D. scapigera</i>
palm heart (shoot) eaten2	<i>Calamus egregius</i> ; <i>C. gracilis</i> ; <i>C. javensis</i> ; <i>C. muricatus</i> ; <i>C. myriacanthus</i> ; <i>C. paspalanthus</i> ; <i>C. rhabdocladus</i> ; <i>C. salicifolius</i> ; <i>C. siamensis</i> ; <i>C. simplicifolius</i> ; <i>C. subinermis</i> ; <i>C. tenuis</i> ; <i>C. viminalis</i> <i>Daemonorops fissa</i> ; <i>D. longispatha</i> ; <i>D. margaritae</i> ; <i>D. melanochaetes</i> ; <i>D. periacantha</i> ; <i>D. scapigera</i> ; <i>D. schmidtiana</i> ; <i>D. sparsiflora</i> <i>Plectocomiopsis geminiflora</i>
seeds chewed	<i>Calamus walkeri</i>
fruit in traditional medicine	<i>Calamus castaneus</i> ; <i>C. longispathus</i> <i>Daemonorops didymophylla</i>
root in traditional medicine	<i>Calamus acanthophyllus</i>
palm heart (shoot) in traditional medicine	<i>Calamus exilis</i> ; <i>C. javensis</i> ; <i>C. ornatus</i> <i>Daemonorops grandis</i> <i>Korthalsia rigida</i>
fruit as red dye source	<i>Daemonorops didymophylla</i> ; <i>D. draco</i> ; <i>D. maculata</i> ; <i>D. micracantha</i> ; <i>D. rubra</i>
leaves for thatching	<i>Calamus andamanicus</i> ; <i>C. castaneus</i> ; <i>C. dilaceratus</i> ; <i>C. longisetus</i> <i>Daemonorops calicarpa</i> ; <i>D. elongata</i> ; <i>D. grandis</i> ; <i>D. ingens</i> ; <i>D. manii</i>

Product/Use	Genus and Species
<i>leaflet as cigarette wrapper</i>	<i>Calamus longispathus</i> <i>Daemonorops leptopus</i>
<i>leaf sheath/petiole for grater</i>	<i>Calamus burckianus</i> ; <i>C. insignis</i>
<i>rachis for fishing pole</i>	<i>Daemonorops grandis</i>

Notes:

1. See Table 9-8 for nutritional composition of fruit.
2. *Daemonorops jenkinsiana*. In Cambodia, larvae, which live in the palm heart, are collected for food and sale; the palm heart itself is not eaten.

Sources: Same as Table 4-5.

### Rattan-Related Issues

Four topics are relevant to the future of rattan as a non-wood forest product and should be touched upon here. They are: 1) increased wild sources of raw cane; 2) sustainable management of wild stands; 3) conservation of threatened rattans and their habitat; and 4) socio-economic and cultural issues related to rattan collecting. Each of these topics should be reviewed as part of any forestry activity which includes rattan collecting.

**Increased wild cane sources.** Quantities of useable raw cane can be increased in two major ways. One is to improve harvesting techniques to minimize wastage. Rattan gatherers sometimes are unable to reach the full length of commercial cane they have cut and it goes to waste. Immature rattans are cut rather than being allowed to grow to more worthwhile cane lengths. Gatherers may leave harvested small-diameter canes in the forest to rot because they derive more income from carrying out a large-diameter cane. The foregoing problems are inherent to the gathering of non-wood forest products everywhere in the tropics and are discussed as a socio-economic issue.

A second means of increasing wild cane production is to harvest a wider range of different species. At present, only an estimated 20 percent of rattan species have commercial use (Dransfield and Manokaran, 1993). Clearly there is potential to begin to utilize some of the remaining 80 percent of the species. To introduce new commercial species to the industry requires involvement at every level of the product chain from the rattan gatherer to the rattan product consumer. Central to finding new commercial rattan species is field research on the plants themselves, studies of their technical properties and informing collectors and end users about the new raw material. A good example of an attempt to increase wild cane production is to be found in South India where research efforts are focusing on 15 native *Calamus* spp. as sources of raw material for cane furniture and other products (Renuka, 1992; Bhat, 1992; Renuka and Bhat, 2002). Lesser known-canes can contribute to wild rattan supplies; some also are suitable for silvicultural trials (Dransfield, 1985).

**Rattan management.** To insure stable rattan supplies in the future, management is a reasonable compromise between continuing to rely exclusively on wild rattans and outright rattan cultivation. Rattans pose unique management difficulties because of their growth habit since they may climb from tree to tree in the forest canopy. This creates problems in the inventory of standing stock as well as in monitoring of the conditions of rattan populations and their natural regeneration.

Three basic types of management are applicable to rattans:

1) Natural regeneration within the forest. This level of management requires no specific technical inputs but does require that a sustainable harvest plan be developed and adopted. Protected areas such as national parks, nature preserves or watersheds any of which permit gathering of wild resources are highly suitable to this management approach. Siebert (1995) has shown that sustained-yield rattan harvest is achievable within two Indonesian national parks. Designating extractive reserves for rattan harvest, as suggested by Peluso (1992) for Kalimantan, Indonesia, would fit within this management approach.

2) Enhanced natural regeneration and or cultivation within natural forest. In this instance, forest cover is still largely intact (the area may have been selectively logged) and an area may be set aside for rattan and other non-wood forest products. Management inputs may include clearing of competing undergrowth vegetation in naturally-occurring forest canopy gaps to promote young rattan growth. Selective felling to create artificial canopy gaps is also an option. It is well known that canopy gaps are highly favorable for rattan growth (Chandrashekhara, 1993). Priasukmana (1989) reported on planting rattan within the natural forest of East Kalimantan, Indonesia, to increase rattan stock.

3) Rattan cultivation as part of shifting cultivation or agroforestry. Incorporation of rattan into shifting cultivation is an indigenous system in Kalimantan. Weinstock (1983) describes how the Luangan Dayaks clear a forest plot to plant food crops for 1-2 years, but before leaving the land fallow they plant rattan. When the rotation is repeated in 7-15 years, the farmer first harvests the rattan then clears the plot again for food crops. Godoy (1990) suggests that traditional rattan cultivation be incorporated into new agroforestry systems to raise small landholder income. In Malaysia, trials to interplant rattans with rubber trees are being studied (Aminuddin *et al.*, 1985). All of these approaches merit further attention since rattan is not a suitable monocultural crop.

**Rattan conservation.** Conservation is a matter of expediency for rattans because of the raw material shortages being experienced by rattan industries in Southeast Asia and because of the potential loss of essential gene pools for rattan domestication and plantation establishment. It is somewhat encouraging that the need for rattan conservation is beginning to be recognized seriously. A CIRAD-Foret collaborative program in Malaysia focused on seed collection, establishment of conservation plots and genetic diversity (Durand, 1995). Five of the major rattan species listed in Table 4-5, Table 4-6 and Table 4-7 are under study: *Calamas manan* (threatened); *C. trachycoleus* (non-threatened) and *C. caesius*, *C. optimus* and *C. subinermus* (all of unknown status).

Rattan conservation cannot be separated from general forest conservation. The combination of decreasing forest cover and over-exploitation of wild canes threatens the very survival of a commercial rattan industry in many parts of Southeast Asia (Dransfield, 1989). As shown in

Table 4-7, the sad fact is that we do not know enough about the conservation status of wild rattans to identify which areas should be the focus of priority conservation actions.

**Socio-economic and cultural issues.** The impact on local rattan collectors on the decline in wild rattan resources is often overshadowed by the more publicized concerns for the rattan product industry. Affected groups may be indigenous people living a relatively traditional life in or near the forest or small landholders eking out a living with shifting cultivation. There are a number of instances of local groups which are dependent upon gathering wild rattan and other non-wood forest products for the cash income to purchase necessary modern industrial goods.

Examples from the Philippines include the following: Antolin (1995) writes of rattan collecting as an important source of employment in the uplands of northeastern Luzon; Conelly (1985) describes how rattan and copal collecting represents a significant source of cash income for the Tagbanua of Palawan Island; and Siebert and Belsky (1985) relate how a lowland village depends upon collecting rattan and harvesting timber for a key source of livelihood. Peluso (1992) and Weinstock (1983), already referred to above with respect to Kalimantan, Indonesia, also stress the socio-economic importance of rattan. In Malaysia, Kiew (1991) and Lim and Noor (1995) emphasize how the Orang Asli communities have a stake in the future of rattan collecting.

Two interrelated socio-economic elements play a vital role in the future of rattans as non-wood forest products. One is land tenure. Rattan management, of whatever kind, will only be a success if those involved have clear title to the land, or have long and easily renewable lease rights, so that the future benefits of sustainable practices can be guaranteed. The second element involves the rattan collectors' stake in the rattan resources they exploit. Currently, a rattan collector rationally maximizes his or her income by harvesting the best and most accessible canes, because they are paid by the piece for their labors. Larger canes bring the best price and minimizing walking time is an efficiency for the collector. This same situation applies to most non-wood forest product collecting. What is needed is a means to provide the rattan collector with a stake in wild resource management and a method of payment which rewards sustainable practices over excessive or wasteful exploitation.

## Recent Developments

**FAO Expert Consultation of 2000.** A new stage of rattan development began in late 2000 through an expert consultation meeting organized by FAO. The consultation focused on three key issues: rattan resources, socio-economics and environment and conservation. A proceedings, entitled *Rattan: Current research issues and prospects for conservation and sustainable development* (Dransfield *et al.*, 2002). Results of the consultation also were featured in a theme issue on rattans in the FAO journal *Unasylva*, No. 205, 2001/2002.

Actions recommended in the consultation proceedings were presented under three headings:

1) Resources. Intensify conservation efforts among the countries involved; develop suitable resource assessment protocols, to include basic biological studies of the species; improve techniques of enrichment planting and wild stand management.

2) Products. Research on physical properties of commercial rattans and potential of lesser-known species; improve processing practices to reduce post-harvest loss and cane deterioration; introduce uniform standards for grading of canes.

3) Policies and institutional support. Raise awareness of the rattan sector to decision-makers; strengthen and coordinate institutions with regard to rattan conservation, including more NGO and private sector involvement; provide tenure security to gatherers and planters; introduce incentives for rattan cultivation and increased benefits to households and planters; deregulate markets to benefit collectors and traders; strengthen extension support at the village level and to small processors; provide training of gatherers and planters, and technical support as necessary. One direct action resulting from the FAO consultation was a rattan glossary to clarify terms and definitions associated with the rattan industry (Johnson and Sunderland, 2004). The consultation recommendations have provided useful guidelines to the rattan development activities being carried out under programs headquartered in Laos and The Philippines, described below.

**WWF Sustainable Rattan Harvesting and Production Regional Program: Cambodia, Laos and Vietnam.** In 2006, World Wide Fund for Nature (WWF), supported by the European Commission Union, IKEA and German and Dutch development agencies, began an ambitious set of activities aimed at sustainable production and sustainable production systems of rattan products. The projects are part of the WWF Greater Mekong Program, based in Vientiane, and focuses on the valuable rattan resources of Cambodia, Lao and Vietnam. Globally, the value of trade in rattan canes amounts to an estimated \$4 billion per year. The Greater Mekong's rattan industry has the potential to gain a greater share of the world market, based upon the more than 50 species of rattans native to the three countries. WWF plans to extend the project activities to 2015.

In addition to making a contribution to the national economies of Cambodia, Lao and Vietnam, the project directly benefits village communities which rely heavily upon the rattan trade, accounting for up to 50 percent of cash income in villages located in areas of significant cane resources. The rattan industry in these villages represents a major force to alleviate poverty. Project field activities will target selected provinces in the three countries which have a high availability of wild canes; and small and medium sized rattan processing facilities near major cities. At the consumer level, the project will carry out activities in rattan consuming countries, especially in Europe, to educate retailers and consumers about "green" rattan products derived from sustainable production.

Rattans require a forest habitat for their growth and reproduction. Therefore, sustainable rattan production and the maintenance of forest cover are interconnected. An industry based on sustainable rattan production provides a financial incentive to maintain 50,000 hectares of forest in Cambodia, Lao and Vietnam brings with it a reduction of economic costs and environmental degradation in five ways: 1) reduce unsustainable harvesting practices; 2) minimizing raw material wastage through more efficient handling and processing; 3) reduce environmental pollution and improve conditions in processing facilities for better worker health, resulting from toxic chemicals used in used in cane processing and their disposal; 4) give the advantage to legitimate producers and traders by curtailment of illegal cane production and trade through appropriate national legislation and enforcement; 5) enhance cane product quality to give producers competitive products suitable for international markets.

Major project objectives until 2015 are the following: 1) by 2010: engage 100 communities within the three countries in sustainable rattan production; 2) by 2011: have 40 percent of small and medium cane processors engaged in cleaner production operations, and 15 percent of processing facilities turning out environmentally-friendly products for international markets; 3) by 2015: have 50 percent of the rattan processors in the three countries operating to minimize environmental pollution and to turning out products meeting international market standards.

For practical reasons, the WWF Program has given initial attention to rattans in Laos. The chief reason for that focus was the existence of an excellent guide to the rattans of that country (Evans *et al.*, 2001), which described 51 native species. A companion guide to the rattans of Cambodia (Khou, 2008) has been published by WWF. It provides detailed information on the 18 native Cambodian rattans and sets the stage for additional studies.

Secondary noncane products also are being studied, as reflected in a technical report on rattan shoot production as a food crop in Lao. The report states that the native *Calamus tenuis* is the most important source of shoots, about 75 percent of current production originating coming from plantations (Campbell, 2009).

Along with promoting sustainable production of canes from wild sources, the program has investigated rattan cultivation as a complementary activity, to broaden the raw material base. To this end, a manual on rattan growing was published (Sengdala, 2008). The manual draws together current technical information for nursery and plantation operations from experiences in other Asian countries. It also identifies 10 suitable native species (Table 4-10).

**Table 4-10 Commercial Native Rattan Species of Lao**

Genus and Species	Commercial Cane Species	Species with Cultivation Potential for Cane Production	Species with Cultivation Potential for Shoot Production
<i>Calamus bimaniferus</i>	X		
<i>Calamus gracilis</i>	X	X	
<i>Calamus palustris</i>	X	X	
<i>Calamus poilanei</i>	X	X	
<i>Calamas rudentum</i>	X	X	
<i>Calamus siamensis</i>	X	X	
<i>Calamus solitarius</i>	X	X	
<i>Calamus tenuis</i>	X	X	X
<i>Calamus tetradactylus</i>	X		
<i>Calamus viminalis</i>	X	X	

Genus and Species	Commercial Cane Species	Species with Cultivation Potential for Cane Production	Species with Cultivation Potential for Shoot Production
<i>Daemonorops jenkinsiana</i>	X	X	X
<i>Myrialepis paradoxa</i>		X	
<i>Korthalsia laciniosa</i>	X		

Source: Campbell, 2009; Evans, 2001.

The WWF rattan program has been designed with great care and given its vertical integration all of the necessary components are in place for future success.

ITTO-Philippines-ASEAN Rattan Project. This four-year project was implemented in June 2006 and focuses on demonstration and application of production and utilization technologies for rattan sustainable development. It is comprised of five components: pilot demonstrations, research, training, database/website and networking.

Geographically, it includes the ASEAN countries and is headquartered in Laguna, Philippines. Through the end of 2008, as gleaned from the project's newsletter (RattaNews), the following accomplishments were reported.

1) Rattan pilot demonstrations were on-going in Cambodia, Indonesia, Lao, Myanmar, Philippines, Thailand and Vietnam. Demonstrations have involved nursery operation and out-planting and utilized a few key species in each country; primarily for cane production but also for rattan shoots (Thailand) and resin (Indonesia).

2) Training programs, 21 in total, have been carried out; most widely in the Philippines, but also in Cambodia, Indonesia, Lao, Thailand and Vietnam. A number of agencies collaborated in the rattan training activities which included rattan weaving.

3) The research component involves eight different projects, ranging from studies of genetic variation and sex determination of key species (Philippines), to gender role studies in forest enrichment plantings (Vietnam). Final reports of each project are in progress, which include a guide to the identification of Philippine rattans.

4) The project website/database is updated on a regular basis and will include the various final project documents when they are completed ([www.aseanrattan.org](http://www.aseanrattan.org)).

5) Networking has involved organizations in the Philippines, as well as regional and international bodies, to share information and avoid duplication of effort. The project newsletter has served as a primary communications tool.



**Figure 4-1** *Cultivated sago palm (Metroxylon sagu) in Sarawak, East Malaysia. Photograph by Dennis Johnson.*



**Figure 4-2** *Sago palm starch (Metroxylon sagu) for sale in West Kalimantan, Indonesia. The starch is wrapped in leaves from the same palm. Photograph by Johanis Moge.*





**Figure 4-3** *Rattan canes (Calamus spp.) drying in the sun in South Sulawesi, Indonesia. Photograph by Johanis Moge.*



**Figure 4-4** *Rattan factory. Java, Indonesia. Photograph by Dennis Johnson.*



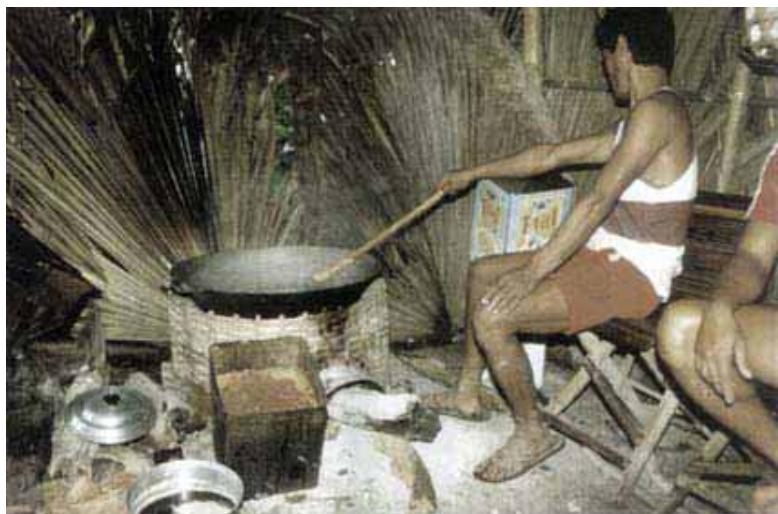
**Figure 4-5** *Nipa palm (Nypa fruticans) in habitat in Sarawak, East Malaysia.*  
*Photograph by Dennis Johnson.*



**Figure 4-6** *Salak palm fruits (Salacca zalacca) for sale. Java, Indonesia.*  
*Photograph by Dennis Johnson.*



*Figure 4-7 House wall panels made from buri leaves (Corypha utan). Mindanao, Philippines. Photograph by Dennis Johnson.*



*Figure 4-8 Boiling down sap of buri palm (Corypha utan) to make sugar. Mindanao, Philippines. Photograph by Domingo Madulid.*





**Figure 4-9** *Calamus merrillii* fruits (center) being sold in the Baguio Market, Philippines. Photograph by Domingo Madulid.



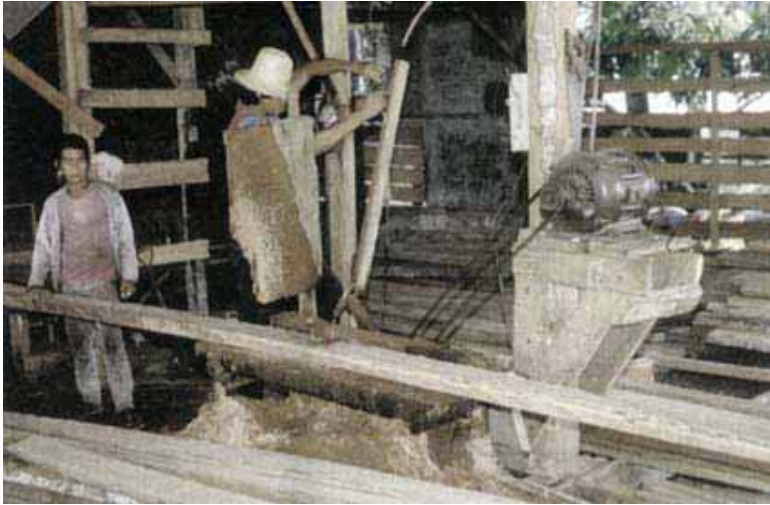
**Figure 4-10** Wild date palm (*Phoenix sylvestris*) along a roadside. West Bengal, India. Photograph by Dennis Johnson.



**Figure 4-11** *Brushes made from palmyra palm (*Borassus flabellifer*) leaf-base fiber. Tamil Nadu, India. Photograph by Dennis Johnson.*



**Figure 4-12** *Assorted products made from palmyra palm (*Borassus flabellifer*) leaf fiber. Tamil Nadu, India. Photograph by Dennis Johnson.*



**Figure 4-13** *Sawing boards of coconut wood (*Cocos nucifera*) in Mindanao, Philippines. Photograph by Dennis Johnson.*



**Figure 4-14** *Tapping nipa palm (*Nypa fruticans*) using a bamboo container to collect the sap. Mindanao, Philippines. Photograph by Domingo Madulid.*