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USES OF EPIPHYTES, LIANAS, AND PARASITES BY THE SHUAR PEOPLE OF AMAZONIAN ECUADOR

BRADLEY C. BENNETT[1]

Institute of Economic Botany, The New York Botanical Garden,
Bronx, New York 10458-5126
[1]Current address: Department of Biological Sciences, Florida International University,
Miami, Florida 33199

ABSTRACT. Among the 670 documented plant species used by the Shuar of Amazonian Ecuador are 97 non-cultivated, mechanically-dependent taxa: vines, epiphytes, hemi-epiphytes, and parasites. The most common uses of these plants are for medicine, animal forage, and food. Twenty-five percent or more of craft, fiber, personal, and poison plants are mechanically-dependent species. The Shuar use six or more species of Araceae, Bignoniaceae, Cucurbitaceae, Ericaceae and Orchidaceae. The 17 useful species of Araceae ar the most provided by any family. Despite their abundance, Bromeliaceae and Orchidaceae are of limited importance, providing mostly ornamentals and minor medicines. Mechanically-dependent species constitute 15% of the plant species used by the Shuar. Analysis of data from other studies of native Amazonian people in Ecuador show that epiphytes and lianas comprise 10–22% of the species used. Twenty-one epiphyte and liana species are reported in two or more studies from this region. Three lianas are among the most important non-food plants for the Shuar and other native people of northwest Amazonia. *Lonchocarpus nicou* provides a fish poison, *Strychnos tomentosa* an arrow poison, and *Banisteriopsis caapi* the principal hallucinogen of northwest Amazonia.

Usos de las epífitas, lianas, y parásitas por las poblaciones Shuar del Ecuador amazónico.

RESUMEN. Entre las 670 especies registradas de plantas usadas por los Shuar del Ecuador Amazónico, 97 son taxa no cultivadas y mecánicamente dependientes: trepadoras, epífitas, semi-epífitas, y parásitas. Los usos mas comunes de estas plantas son de órden medicinal, forrajero, y alimenticio. Un 25% ó mas de las plantas de uso artesanal, textil, personal, ó tóxico, son también especies mecánicamente dependientes. Los Shuar usan seis ó mas especies de Araceae, Bignoniaceae, Cucurbitaceae, Ericaceae, y Orchidaceae. Las Araceae son las mas representivas con 17 especies. Las especies mecánicamente dependientes constituyen 15% de las plantas usadas por los Shuar. Análisis de datos en otros estudios de poblaciones de nativos del Amazonia indican que las epífitas y las lianas representan entre el 10–22% de las especies usadas por los nativos. Veintiún especies de epífitas y lianas son reportadas en dos ó mas estudios de esta región. Tres lianas están entre las plantas no comestibles más importantes para los Shuar y otros nativos de la Amazonia nor-occidental. *Lonchocarpus nicou* sirve como veneno para los peces, *Strychnos tomentosa* como veneno para las flechas, y *Banisteriopsis caapi* es el principal halucinógeno de la Amazonia nor-occidental.

INTRODUTION

Ecuador (283,560 km^2, about the size of Colorado) has an estimated 25,000 species of vascular plants, more than the United States and Canada combined. Garay (1978) estimated Ecuador's orchid flora to comprise at least 2,000 species. This Latin American country could harbor 3,000 to 4,000 species of epiphytes, vines, and parasites. Amazonian Ecuador, also called the Oriente (130,000 km^2), is about the size of England. Nearly 3,000 species of angiosperms have been found in the Oriente below 600 m (Renner *et al.*, unpubl. data). Of these, more than 500 are epiphytes, lianas, or parasites.

Amazonian Ecuador supports not only a diverse flora but also diverse indigenous populations. At least 17 ethnic groups existed in the region before European contact (Benítez & Garcés, 1988). Only seven remain: Waorani, lowland Quichua, Cofán, Siona, Secoya, Achuar, and Shuar. With a population of 80,000, Descola (1988) considers the Jívaroan or Shuaran groups the most important indigenous nation in the Amazon Basin. Five Shuar groups live in the eastern montaña of Ecuador and Peru: Achuar or Achual, Huambisa, Aguaruna, Mayna, and Untsuri Shuar (Harner, 1984). The 40,000 member Untsuri Shuar is Amazonian Ecuador's second largest indigenous culture (Benítez & Garcés, 1988). Ethnological accounts of the Untsuri Shuar include those by Up de Graff (1923), Karsten (1935), Stirling (1938), and Harner (1984).

Amazonian Ecuador's native people use an estimated half of the 3,000 known species from the region (Bennett, 1991). These 1,500 species probably represent no more than 60% of the total species used. More discoveries await both taxonomists and ethnobotanists. Neither the floristic nor the ethnobotanical inventory will be fully completed, as deforestation and acculturation are proceeding more rapidly than ethnobotanical investigations. Ecuador's population growth rate, more than 3% per year, is the highest

in South America and one of the highest in the world. At the present rate, the population will double in 22 years (Gentry, 1989). My objectives are to discuss mechanically-dependent species used by the Untsuri Shuar of Amazonian Ecuador and to document the importance of epiphytes and lianas for other native people of Amazonian Ecuador.

Study Area

The Untsuri Shuar, previously known as Jívaros, live in Ecuador's Morona-Santiago Province in the region drained by Ríos Pastaza, Morona, Upano, and Zamora (Figure 1). Recently, Shuar have established settlements in Pastaza and Napo Provinces, but most live south of Río Pastaza.

Acosta-Solís (1977) recognizes two climate groups for the region occupied by the Shuar: the warm equatorial belt (0 to 800 m) where temperatures average 24°–28°C, and the subtropical-subandean belt (800 to 1,800 m) where temperatures average 18°–24°C. Most of our study sites were in the equatorial belt. A few occurred in the lower reaches of the subtropical-subandean zone. Precipitation in Morona-Santiago ranges between 2,500 and 3,200 mm yr^{-1} (Costales & Costales, 1983). Precipitation falls evenly throughout the year; usually no month receives less than 100 mm (Balslev & Renner, 1989).

Dystropepts, which are poorly-developed, tropical soils with base saturations of less than 50% (Buol *et al.*, 1980), are the most common soil great group in Morona-Santiago. Other inceptisols (tropaquepts and hydrandepts), entisols (troporthents), and histosols (tropofibrists) also occur in this region (González *et al.*, 1986).

The montane forests I sampled are of medium height (15–25 m canopy), with extensive shrub development and abundant epiphytes. The lowland forests have a higher canopy (20–30 m), fewer epiphytes, and a more stratified shrub layer. A more ubiquitous vegetation, found throughout Amazonian Ecuador, dominates secondary forests and fallow "chacras" (swidden fields). Common pioneer genera include *Alchornea, Cecropia, Erythrina, Ficus, Miconia, Ochroma, Piper, Solanum, Tetrathylacium, Urera, Vernonia,* and *Vismia.*

Methods

I worked primarily in Yukutais, a Shuar Centro near Sucúa, between April 1988 and March 1990. Most Shuar informants were bilingual (Shuar and Spanish). Some older community members, who spoke only Shuar, were the most knowledgeable. Their children or grandchildren translated between Spanish and Shuar.

I used artefact-interview and inventory-interview techniques (Boom, 1987). The artefact technique begins with a product and then identifies the plant from which it came. The inventory technique begins with a plant and then identifies the products made from it. Data from a previous New York Botanical Garden project are also included. Shuar students from the Misión Salesiano Bomboiza collected specimens from nine Shuar villages in Morona-Santiago.

I made preliminary species determinations in Ecuador and deposited at least one voucher in Ecuador's National Herbarium (QCNE), a part of the Museo Ecuatoriano de Ciencias Naturales. Staff at NY and other botanical institutions made further determinations. S. Renner *et al.* (unpubl. data) are preparing a plant checklist for Amazonian Ecuador, which I consulted to resolve problems of synonymy and orthography.

The classification of useful plants (Bennett *et al.*, in press) has 19 non-exclusive, major categories. I consulted five other studies of plants used form Amazonian Ecuador: Pinkley (1973), Davis and Yost (1983), Vickers and Plowman (1984), Alarcón (1988) and Marles (1988). I compare the number of mechanically-dependent species to the total number of species used from these studies.

Results and Discussion

The Shuar use 97 non-cultivated species of epiphytes, vines, and parasites (Appendix A). These are distributed among 32 vascular plant families (Table 1). Epiphytes (29), vines (28), woody vines (16) and climbers (14) are the most common mechanically-dependent life forms used (Table 2). The Shuar use only five hemi-epiphytic, four parasitic and one epiphytic shrub species.

Araceae contribute the greatest number of useful species (17) (Table 1). The Shuar use *Heteropsis oblongifolia* Kunth roots to lash house timbers. They also make baskets from the roots. *Anthurium ernestii* Engl. and *Philodendron* cf. *insigne* Schott roots are used similarly. *Anthurium acrobates* Sodiro and *A. alienatum* Schott leaves are edible. *Anthurium harlingianum* Croat leaves are used to cover pots, especially large pots of yuca (*Manihot esculenta* Crantz). The Shuar use *Rhodospatha* cf. *montziana* (Schott) Croat leaves to wrap meat, yuca, and other vegetables. They tie the leaves with roots or bark fibers, then place the bundle on hot coals to cook. This package is known as an "ayampaku."

Araceae also provides many medicines. The Shuar place crushed *A. alienatum* fruits on the skin to kill burrowing insect larvae. They use *Monstera spruceana* (Schott) Engler leaves to treat internal swelling in the region of the liver. The

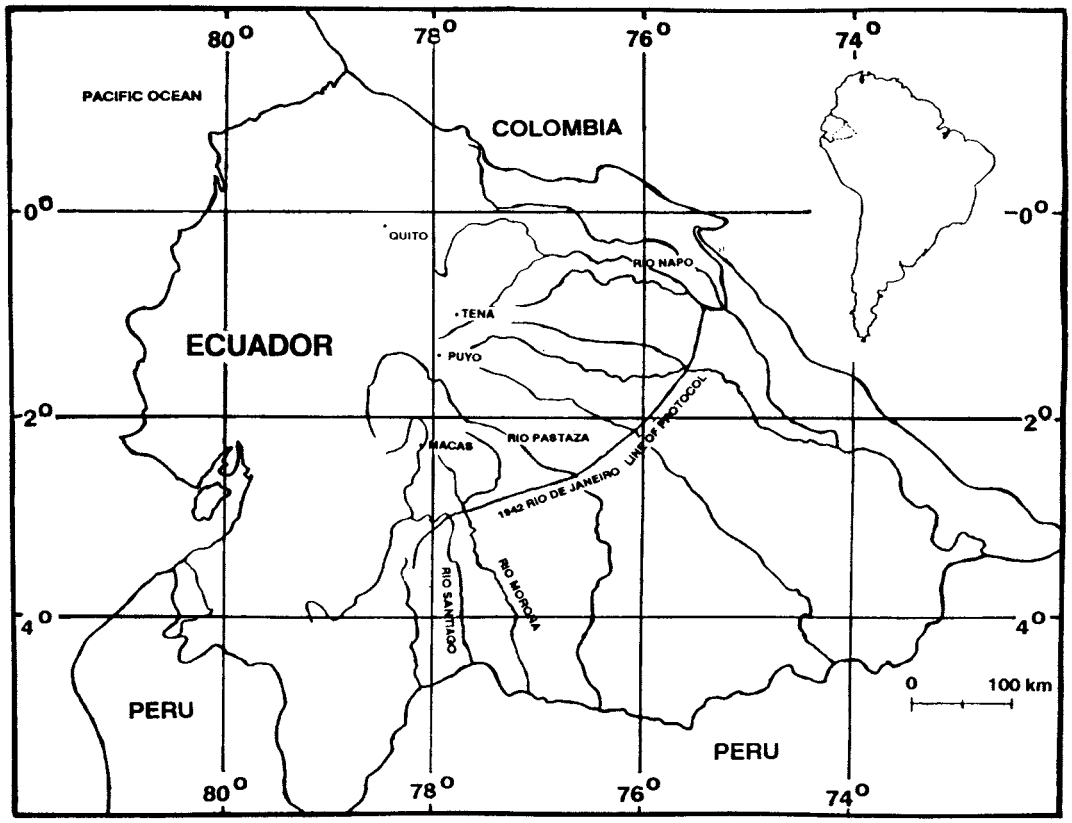

FIGURE 1. Morona-Santiago Province, Ecuador, showing the principal rivers and ethnobotanical study sites.

liquid from the petiole of *P.* cf. *insigne* is said to cure dandruff. Fresh latex or powdered ash from *Syngonium podophyllum* Schott helps wounds heal more rapidly. The Shuar also use *Anthurium eminens, A. ernestii* and *A. harlingianum* in medicines to treat animals.

Ericaceae provides the second highest number of useful lianas and epiphytes. *Satyria panurensis* (Bentham) Bentham & Hooker, *Cavendishia* sp., and *Psammisia* sp. are forage species, consumed by animals that the Shuar eat. The Shuar make a tea from *Sphyrospermum buxifolium* Poeppig & Endlicher leaves to treat stomach aches and a tea from *Themistoclesia* sp. leaves to treat liver ailments. Women use the flower of two *Psammisia* spp. in ornamental head-dresses.

Bignoniaceae, Cucurbitaceae, and Orchidaceae each provide six useful species. The Shuar make baskets from *Mansoa verrucifera* (Schlecter) A. Gentry (Bignoniaceae) stems. *Arrabidaea chica* (Humboldt & Bonpland) Verlot is the source of a brown dye. *Macfadyeana uncata* (Andrews) Sprague & Sandwith stems are used to fashion bat traps. The Shuar use crushed leaves of *Pachyptera standleyi* (Steyermark) A. Gentry to treat bronchitis. One of the more intriguing species of Bignoniaceae is *Tynnanthus polyanthus* (Burret) Sandwith. Pregnant women believe that drinking a medicine made from this plant changes the sex of their unborn child.

Among the useful non-domesticated cucurbit species is *Melothria pendula* Linnaeus, which bears edible fruits. The Shuar burn oil-rich *Fevillea cordifolia* Linnaeus seeds as substitutes for candles. Domestic animals eat the seeds of this species. The Shuar also make a medicine to treat internal parasites from them.

Useful orchids include *Vanilla* sp., whose fruits are used to flavor sugarcane alcohol, to make rings, and as a perfume (Broseghini & Frucci, 1986). The Shuar claim that eating the stem of a *Catasetum* sp. reduces heart pain. They use the juice from *Campylocentrum* sp. pseudobulbs to treat skin ulcers. Several orchid species are planted around home sites as ornamentals.

Twenty-eight other vascular plant families contribute four or fewer species of useful mechanically-dependent species. The Shuar use *Begonia maynensis* A. de Candolle and *Begonia parviflora* Poeppig & Endlicher (Begoniaceae) in medicines. They use some Bromeliaceae as ornamentals. The Shuar name for epiphytic bro-

TABLE 1. Number of mechanically-dependent species arranged by family and life form. CLI = climbers (e.g., many Araceae), EPI = herbaceous epiphytes, HEM = hemi-epiphytes, PAR = parasites, SHR = epiphytic shrubs, VIN = herbaceous vines, and WVI = woody vines.

Family	Life form							Total
	CLI	EPI	HEM	PAR	SHR	VIN	WVI	
Araceae	7	10						17
Aristolochiaceae						1		1
Asteraceae						2		2
Begoniaceae	2							2
Bignoniaceae							6	6
Bromeliaceae		2						2
Cactaceae		3						3
Cecropiaceae			1					1
Clusiaceae			3					3
Cucurbitaceae						6		6
Cyclanthaceae	4							4
Dioscoreaceae						1		1
Ericaceae	1	1					5	7
Fabaceae						1	1	2
Gesneriaceae						4		4
Liliaceae						1		1
Loranthaceae				4				4
Malpighiaceae							2	2
Marcgraviaceae					1			1
Menispermaceae						1		1
Moraceae			1					1
Orchidaceae		6						6
Passifloraceae						3		3
Piperaceae		4						4
Rubiaceae						2		2
Sapindaceae						1	1	2
Selaginellaceae		2						2
Smilacaceae							1	1
Solanaceae						1		1
Urticaceae						1		1
Verbenaceae						1		1
Vitaceae						2		2
Family indet.		1						1
Total	14	29	5	4	1	28	16	97

TABLE 2. Number of mechanically-dependent species arranged by life-form. The right column shows the number of species used but does not include mechanically-dependent species found only in cultivation.

Life form	Mechanically-dependent species	
	Total	Number used
Climbers	17	14
Epiphytes	80	29
Hemi-epiphytes	8	5
Parasites	8	4
Shrubs	4	1
Vines	59	28
Woody vines	24	16
Total	200	97

meliads, including *Aechmea, Catopsis, Guzmania, Streptocalyx* and *Tillandsia* is "kuish." Some informants use the name "karis," a name that also refers to epiphytic orchids. Primates, including the woolly monkey (*Lagothrix lagothrica*), a preferred Shuar food species, eat the young inflorescences and drink water from the tanks of *Guzmania* spp. Locating these epiphytes helps Shuar hunters locate monkeys.

The fruits of *Epiphyllum phyllanthus* (Linnaeus) Haw. var. *phyllanthus* (Cactaceae) are edible. Shuar women use *Asplundia ecuadoriensis* (Harl.) Harl. (Cyclanthaceae) flowers for perfume. They drink one cup of juice made from *Dalbergaria* sp. as a permanent contraceptive (Gesneriaceae). A birth control medicine is also made from an unidentified *Smilax* species (Smilacaceae). According to a Shuar legend, if you touch the flowers of an unidentified gesneriad species, your ears

TABLE 3. Number of mechanically-dependent species arranged by use category and life form. CLI = climbers (e.g., many Araceae), EPI = herbaceous epiphytes, HEM = hemi-epiphytes, PAR = parasites, SHR = epiphytic shrubs, VIN = herbaceous vines, and WVI = woody vines. Total MD = number of mechanically-dependent species per use category. Percent useful sp. = percent of useful species in each category that are mechanically-dependent.

Use category	Life form							Total MD	Percent useful sp.
	CLI	EPI	HEM	PAR	SHR	VIN	WVI		
Commercial									0
Construction	2							2	2
Craft	3		1		1	1	1	7	37
Dye/paint			1				1	2	18
Fiber	1	4				1	1	7	27
Fishing							1	1	11
Food		8	1			5	2	16	8
Food processing	4	1						5	22
Forage		1	3	4	1	7	2	18	13
Fuel						1		1	1
Hunting							1	1	4
Medicine	6	14		1		15	5	41	17
Ornamental		4						4	19
Personal	1	3				2	2	8	30
Poison						2	2	4	25
Ritual/mythical						2	3	5	14
Tools									0
Veterinary	3	2						5	20
Miscellaneous	1					2		3	19

will fall off. *Peperomia* spp. (Piperaceae) are important medicines.

Three lianas are among the most important non-food plants of the Shuar. They make a poison from the roots of *Strychnos tomentosa* Bentham (Loganiaceae) that they apply to darts made from palm petioles. Blowguns made from the stem *Bactris gasipaes* Kunth (Arecaceae) propel the darts. Shotguns have replaced blowguns and poisoned darts as the most common hunting weapons. Nonetheless, the Shuar still occasionally use these traditional weapons.

The second important liana is *Lonchocarpus nicou* (Aubl.) DC. (Fabaceae), known in Shuar as "timiu." The Shuar place crushed roots in small streams. Rotenone leached from the roots causes fish to float to the surface where they can be easily caught or speared. *L. nicou* is not the only fish poison used, but the Shuar consider this the most effective.

The most important liana is *Banisteriopsis caapi* (Spruce ex Grisebach) Morton (Malpighiaceae). Known as "natem" in Shuar, or more commonly by the Quichua name "ayahuasca" (soul vine), *B. caapi* is a central element of Shuar culture. Shamans ("uwishin" in Shuar) take hallucinogens to communicate with the spirit world, diagnose illnesses, determine guilt, and see the future. The Shuar believe that witchcraft or sorcery causes most diseases. Evil shamans send magical darts called "tsentsaks" that cause illness or death. Healing shamans see and remove these while under the effects of *B. caapi*. One Shuar shaman said that after drinking natem, the body of his patient appears like an x-ray. He can then fine the tsentsaks that cause the ailment. Another Shaman described visions he sees while under ayahuasca's influence: boas, frogs, tigers, dogs, and trees are common. These visions often transform one to another (Bennett, unpubl. data).

Shuar shamans prepare *B. caapi* in several ways. A piece of stem (50–100 cm long) is split into small pieces and then boiled in several liters of water until a thick, reddish-brown liquid remains. Other plant species are usually added. Pedro Kunkumas, a shaman from the village Yukutais, adds the liana "yaji" (*Diplopterys cabrerana* (Cuatrec.) Gates), "kushinkiap" (*Herrania* sp.), "wais" (*Ilex guayusa* Loesener), "winchu" (*Heliconia* spp.), and "mukayashu" (an unidentified Malpighiaceae species).

The most common use of epiphytes and lianas are for medicine (41), forage (18), and food (17) (TABLE 3). Epiphytes and lianas also provide five or more craft, fiber, food processing, personal, ritual/mythical, and veterinary plants. Comparing the number of mechanically-dependent species to the total number of species used in each category reveals their relative importance. Mechanically-dependent taxa constitute 20% or more of all craft, fiber, food processing, personal, poison and veterinary plants (TABLE 3).

TABLE 4. Number of mechanically-dependent species used by the Shuar (SHU), Cofán (COF), Quichua (QU1 and QU2), Siona-Secoya (SIO) and Waorani (WAO) people of Amazonian Ecuador and the total number of species (Total) used per family.

Family	SHU[1]	COF[2]	QU1[3]	QU2[4]	SEC[5]	WAO[6]	Total
Adiantaceae		1					1
Apocynaceae		1					1
Araceae	17	5	12	4	4	3	40
Aristolochiaceae	1			3			4
Aspleniaceae				1	1		1
Asteraceae	2		1				3
Begoniaceae	2	1				1	4
Bignoniaceae	6	1	1	2	1	1	8
Bromeliaceae	2		1				3
Cactaceae	3		1	1		1	2
Cecropiaceae	1						1
Clusiaceae	3						3
Cucurbitaceae	6	3	1	1	2	1	9
Cyclanthaceae	4	1	1		1		6
Dioscoreaceae	1	1		2	1	1	3
Ericaceae	7						7
Fabaceae	2	1		2	1	1	4
Gesneriaceae	4		4	3	3		14
Hymenophyllaceae		1					1
Liliaceae	1						1
Loganiaceae		5		1			5
Loranthaceae	4		3				7
Malpighiaceae	2	2	1	2	2	2	5
Marcgraviaceae	1		2			1	5
Melastomataceae					1		1
Menispermaceae	1	2		1		1	4
Monimiaceae						2	1
Moraceae	1						1
Orchidaceae	6	3		2			11
Passifloraceae	3	2	2				7
Piperaceae	4		2				8
Rubiaceae	2						2
Sapindaceae	2	3		1	2		7
Selaginellaceae	2		2	1	1		5
Smilacaceae	1		1				2
Solanaceae	1				1		2
Urticaceae	1	1	1		2	1	2
Verbenaceae	1			1			2
Viscaceae			1				1
Vitaceae	2		2				3
Family indet.	1					1	2
Total MD spp.	97	34	39	28	23	17	199
Total no. sp. used	640	175	206	125	224	116	—
Percent MD used	15.2	19.4	18.9	22.4	10.3	14.7	—

[1] This study.
[2] Pinkley, 1973.
[3] Alarcón, 1988.
[4] Marles, 1988.
[5] Vickers & Plowman, 1984.
[6] Davis & Yost, 1983.

The importance of lianas and epiphytes is not limited to the Shuar. Five other studies from Amazonian Ecuador identified 17–34 mechanically-dependent taxa representing 10.3–22.4% of all the useful species found (TABLE 4). Lowland Amazonian people in Ecuador use a total of 40 aroid species. Gesneriaceae (14) and Orchidaceae (11) also provided many beneficial species. A complete list of mechanically-dependent species used by Ecuador's indigenous people is in APPENDIX B.

Twenty-one epiphytes and lianas were cited in

TABLE 5. Mechanically-dependent species reported in two or more studies from Amazonian Ecuador arranged by family and species. STAT = cultivation status: C = cultivated, P = protected, W = wild.

Family	Species	No. reports	Stat
Araceae	*Anthurium alienatum* Schott	2	W
	Heteropsis oblongifolia Kunth	2	P, W
	Anthurium eminens Schott	2	W
	Monstera spruceana (Schott) Engl.	2	C, W
	Syngonium podophyllum Schott	3	W
Aspleniaceae	*Lomariopsis japurensis* (von Mart.) Sm.	2	W
Bignoniaceae	*Arrabidaea chica* (H.&B.) Verlot	3	P, W
	Pachyptera standleyi (Steyerm.) Gentry	3	P, W
Cactaceae	*Epiphyllum phyllanthus* (L.) Haw.	3	W
Cucurbitaceae	*Cayaponia ruizii* Cogn.	3	P, W
	Fevillea cordifolia L.	3	P, W
Cyclanthaceae	*Thorocarpus bissectus* (Vell.) Harl.	2	W
Dioscoreaceae	*Dioscorea trifida* L. f.	4	C, W
Fabaceae	*Lonchocarpus nicou* (Aubl.) DC.	4	C, W
Loganiaceae	*Strychnos peckii* B. L. Robinson	2	P, W
Malpighiaceae	*Banisteriopsis caapi* (Spr. ex Griseb.) Morton	5	P, W
	Diplopterys cabrerana (Cuatrec.) Gates	3	P, W
Menispermaceae	*Abuta rufescens* Aubl.	2	W
Selaginellaceae	*Selaginella exaltata* (Kze.) Spring.	2	W
Urticaceae	*Urera baccifera* (L.) Gaudich.	4	W
Vitaceae	*Cissus erosa* L. C. Richard	2	W

two or more of the six studies consulted (TABLE 5). These included several that are important to indigenous people throughout lowland Amazonia. The Shuar use 15 of these species. Two of the three lianas central to Shuar culture, *Banisteriopsis caapi* and *Lonchocarpus nicou,* have been reported from four or five studies. Species closely related to the third important Shuar liana, *Strychnos tomentosa,* also are used widely.

Mechanically-dependent taxa are important in other regions besides Amazonian Ecuador. Highland Quechua-speakers in Peru use *Tillandsia ionochroma* André ex Mez for wedding decorations (Bennett, 1990). Highland Quichua-speakers of Ecuador sell *Tillandsia usneoides* (L.) L. and *T. incarnata* H.B.K. as Christmas decorations in Quito (Bennett, unpubl. data). Peruvians sell *Mandevilla scabra* (R.&S.) K. Schumann bark in Iquitos's Belém Market. The Tikunas of Colombia treat conga ant bite stems with juice from *Syngonium yurimaguense* Engler stems (Schultes & Raffauf, 1990).

The substantial use of mechanically-dependent taxa has implications in the evolution and conservation of these plants. Indigenous people protect many lianas and epiphytes when they clear fields, or they intentionally cultivate these species (TABLE 5). Human populations may artificially increase the abundance of these species at the expense of other less useful species. Humans spread these plants, extending their natural range, and they may select for preferred properties. Shamans commonly mention the variability in strength of different *B. caapi* vines. They exchange high-yielding varieties within and between ethnic groups.

Human populations may increase the abundance and distribution of some species. They also may cause the extinction of plant species by over-utilization. Soil exhaustion is a widely declared cause of shifting populations in Amazonia, but other reasons exist. These include the depletion of resources such as game animals or trees for canoes (Hames & Vickers, 1983; Harner, 1984; Vickers, 1988). None of the studies cites the depletion of mechanically-dependent taxa but several, including *B. caapi, L. nicou* and *Strychnos* spp., are vital for the maintenance of traditional lifestyles.

The future holds more possibilities for the rational, commercial use of lianas and epiphytes. Some families (Araceae, Gesneriaceae) have great medical potential. The National Cancer Institute of the National Institute of Health and other organizations are now investigating the potential of some of these. Gesneriaceae, Orchidaceae, Bromeliaceae, and Piperaceae also could be harvested sustainably by the horticultural trade.

Conservationists should consider the effects and the needs of indigenous societies as they design conservation programs. As Taylor (1988) states, "When we speak of the preservation of tropical forests we must make clear, explicitly and emphatically, that we mean the preservation

of the forests' flora and fauna and their indigenous human inhabitants." His statements also apply to the preservation of epiphytic species.

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APPENDIX A. Useful Shuar mechanically-dependent species. ha = habit: c—climber, e—herbaceous epiphyte, he—hemi-epiphyte, s—epiphytic shrub, v—herbaceous vine, vw—woody vine. Uses: CM—commercial, CN—construction, DP—dye/paints, FI—fiber, FS—fishing, FO—food, FP—food processing, FR—forage, FU—fuel, HU—hunting, ME—medicine, OR—ornamental, PE—personal, PO—poison, RM—ritual/mythical, TO—tools, VE—veterinary, MI—miscellaneous.

		Use																	
Species arranged by family	ha	CM	CN	CR	DP	FI	FS	FO	FP	FR	FU	HU	ME	OR	PE	PO	RM	TO	VE	MI
Araceae																				
Anthurium acrobates Sodiro	e							×												
Anthurium alienatum Schott	e							×												
Anthurium apaporanum Schultes	e														×					
Anthurium atropurpureum Schultes & Mag.	e														×					
Anthurium eminens Schott	c												×						×	
Anthurium ernestii Engl.	e					×													×	
Anthurium harlingianum Croat	c								×										×	
Heteropsis oblongifolia Kunth	c		×	×		×														
Monstera spruceana (Schott) Engl.	c												×							
Philodendron angustiliatum Engl.	e																			
Philodendron cf. *insigne* Schott	e					×							×							
Philodendron subgen. *Pteromischum*	c																		×	
Rhodospatha montziana (Schott) Croat	c								×											
Spathiphyllum juninense Kr.	e																		×	
Spathiphyllum sp. nov. (Bennett 4076)	e					×								×						
Syngonium podophyllum Schott	c												×							
Genus indet. (Shiki 195)	e							×	×				×							
Aristolochiaceae																				
Aristolochia sp. (Pujupet 1021)	v												×							
Asteraceae																				
Mikania guaco Humboldt & Bonpland	v												×							
Mikania sp. (Warush 83)	v												×							
Begoniaceae																				
Begonia glabra Aublet	c												×							
Begonia maynensis A. DC.	c												×							
Bignoniaceae																				
Arrabidaea chica (H.&B.) Verlot	vw				×															
Arrabidaea sp. (Shiki 216)	vw												×							
Macfadyeana uncata (Andr.) Spr. & Sandw.	vw											×								
Mansoa verrucifera (Schltr.) A. Gentry	vw			×																
Pachyptera standleyi (Steyerm.) Gentry	vw												×							
Tynanthus polyanthus (Burret) Sandwith	vw												×				×			

APPENDIX A. Continued.

Species arranged by family	ha	Use																		
		CM	CN	CR	DP	FI	FS	FO	FP	FR	FU	HU	ME	OR	PE	PO	RM	TO	VE	MI
Bromeliaceae																				
Guzmania melinonis Regel	e									×				×						
Guzmania sp. (4154)	e							×												
Cactaceae																				
Epiphyllum phyllanthus (L.) Haw.	e							×												
Hylocereus polyrhizus (Weber) B.&R.	e							×					×							
Hylocereus sp. (Baker 6657)	e							×												
Cecropiaceae																				
Cousapoa sp. (Bennett 3744)	he							×		×										
Clusiaceae																				
Clusia sp. (Baker 6817)	he				×															
Clusia sp. (Bennett 3607)	he			×																
Clusia sp. (Bennett 3716)	he									×										
Cucurbitaceae																				
Fevillea cordifolia Linnaeus	v									×	×		×							
Gurania cf. *spinulosa* (P.&E.) Cogniaux	v									×										
Gurania sp. (Bennett 3762)	v												×							
Gurania sp. (Bennett 3782)	v									×										
Melothria pendula Linnaeus	v							×												
Genus indet. (Bennett 4148)	v					×				×										
Cyclanthaceae																				
Asplundia ecuadoriensis (Harl.) Harl.	c								×						×					
Thorocarpus bissectus (Vell.) Harl.	c			×																
Genus indet. (Bennett 4052)	c		×						×											×
Genus indet. (Warush 81)	c			×																
Dioscoreaceae																				
Dioscorea trifida Linnaeus f.	v							×					×							
Ericaceae																				
Cavendishia sp. (Bennett 4150)	vw							×								×				
Psammisia sp. (Bennett 4100)	vw														×					
Psammisia sp. (Bennett 4101)	vw							×							×					
Satyria panurensis (Bentham) Bentham & Hooker	vw									×										
Sphyrospermum buxifolium P.&E.	c												×							
Themistoclesia sp. (Bennett 3670)	e												×							
Genus indet. (Bennett 4139)	vw									×										

APPENDIX A. Continued.

Species arranged by family	ha	Use																		
		CM	CN	CR	DP	FI	FS	FO	FP	FR	FU	HU	ME	OR	PE	PO	RM	TO	VE	MI
Fabaceae (Pap)																				
Lonchocarpus nicou (Aubl.) DC.	vw						×									×				
Pueraria phaseoloides (Thunberg) Bentham	v									×						×				
Gesneriaceae																				
Dalbergaria sp. (Bennett 3598)	v												×							
Dalbergaria sp. (Bennett 4082)	v												×							
Genus indet. (Bennett 4149)	v												×				×			
Genus indet. (Bennett 3597)	v												×							
Liliaceae																				
Bomarea cf. *dolichocarpa* Killip	v														×					
Loranthaceae																				
Struthanthus flexilis (Rusby) Kuijt	p									×										
Struthanthus syringifolius Martius	p									×										
Struthanthus sp. (Bennett 3637)	p									×										
Struthanthus sp. (Ananach 149)	p									×										
Malpighiaceae																				
Banisteriopsis caapi (Spruce ex Grisebach) Morton	vw												×				×			
Diplopterys cabreana (Cuatrecasas) B. Gates	vw												×				×			
Marcgraviaceae																				
Marcgravia sp. (Bennett 3722)	s			×						×										
Menispermaceae																				
Cissampelos grandifolia Triana & Planchon	v															×				
Moraceae																				
Ficus sp. (Bennett 3729)	he									×										
Orchidaceae																				
Campylocentrum sp. (Bennett 3717)	e												×							
Catasetum sp. (Warush 61)	e												×							
Elleanthus sp. (Bennett 4124)	e													×						
Maxillaria sp. (Bennett 3719)	e												×							
Vanilla sp. (Baker 6790)	e							×												
Genus indet. (Bennett 3812)	e													×						

APPENDIX A. Continued.

Species arranged by family	ha	Use																		
		CM	CN	CR	DP	FI	FS	FO	FP	FR	FU	HU	ME	OR	PE	PO	RM	TO	VE	MI
Passifloraceae																				
Passiflora edulis Sims	v							×												
Passiflora sp. (Bennett 3737)	v							×												
Passiflora sp. (Warush 86)	v							×												
Piperaceae																				
Peperomia urocarpa Fischer & Meyer	e												×							
Peperomia sp. (Bennett 3706)	e												×							
Peperomia sp. (Pujupet 1026)	e												×							
Peperomia sp. (Shiki 1)	e												×							
Rubiaceae																				
Mannettia glandulosa P.&E.	v												×							
Genus indet. (Kunkumas 182)	v												×							
Sapindaceae																				
Cardiospermum halicacabum Swartz	v			×																
Serjania rubicaulis Benth. ex Radl.	vw					×														
Selaginellaceae																				
Sellaginella sp. (Bennett 3303)	e												×							
Sellaginella sp. (Kunkumas 237)	e														×					
Smilacaceae																				
Smilax poeppigii Kunth	vw												×							
Solanaceae																				
Lycianthes leptocaulis (Rusby) Rusby	v												×							
Urticaceae																				
Urera caracasana (Jacquin) Grisebach	v												×				×			×
Verbenaceae																				
Lantana sp. (Kasent 54)	v												×							×
Vitaceae																				
Cissus erosa L. C. Richard	v									×										
Cissus sp. (Bennett 3435)	v									×			×							
Family indet.																				
Genus indet. (Kasent 17)	e												×							

APPENDIX B. Mechanically-dependent species used by the Cofán (COF), Quichua (QU1 and QU2), Secoya-Siona (SEC) and Waorani (WAO) in Amazonian Ecuador. See TABLE 4 for data sources and APPENDIX A for use category abbreviations.

Species by family	Indigenous group				
	COF	QU1	QU2	SEC	WAO
Adiantaceae					
Polytaenium guayanense (Hieron.) Alston	ME				
Apocynaceae					
Allamandra cathartica Linnaeus	OR				
Araceae					
Anthurium alienatum Schott		ME			
Anthurium aureum Engl.		RM			
Anthurium cf. *guayaquilense* Engl.				ME	
Anthurium cf. *uleanum* Engl.				ME	
Anthurium clavigerum Poeppig & Endl.		ME			
Anthurium eminens Schott					ME, RM
Anthurium gracile (Rudge) Lindley		ME			
Anthurium loretense Corat			ME		
Anthurium polystichum Schultes & Idrobo		ME			
Anthurium sp.		ME			
Anthurium sp.		ME			
Anthurium sp.		ME			
Diffenbachia sp.		ME			
Dracontium loretense Krause			ME		
Heteropsis cf. *oblongifolia* Kunth					CR, HU
Monstera adansonii Schott				ME	
Monstera spruceana (Schott) Engl.			ME		
Philodendron sp.		ME			
Philodendron sp.					ME
Philodendron sp. 3		ME			
Stenospermation amomifolium (Poep.) Schott		ME			
Syngonium podophyllum Schott			ME	ME	
Genus indet.	ME				
Genus indet.	ME				
Genus indet.	ME				
Genus indet.	ME				
Genus indet.	ME				
Aristolochiaceae					
Aristolochia sp.			ME		
Aristolochia sp.			ME		
Genus indet.			ME		
Aspleniaceae					
Lomariopsis japurensis (von Mart.) Smith			ME	MI	
Asteraceae					
Mikania micrantha Kunth		ME			
Begoniaceae					
Begonia rossmanniae A. DC.					FO, ME
Begonia sp.	ME				
Bignoniaceae					
Arrabidaea chica (H.&B.) Verlot	DP			DP	
Mansoa alliacea (Lam.) A. Gentry			ME		
Pachyptera standleyi (Steyerm.) Gentry		ME			ME
Tynnanthus cf. *panurensis* (Bur.) Sandw.			ME		
Bromeliaceae					
Aechmea zebrina L. B. Smith		ME			
Cactaceae					
Epiphyllum phyllanthus (L.) Haw.		FO	ME		

APPENDIX B. Continued.

Species by family	Indigenous group				
	COF	QU1	QU2	SEC	WAO
Cucurbitaceae					
Cayaponia ruizii Cogn.	FO	CR, FO			FO, FR
Cayaponia sp.				CR	
Fevillea cordifolia L.	FU			FU, PE	
Gurania spinulosa (Peop. & Endl.) Cogn.			ME		
Genus indet.	ME				
Cyclanthaceae					
Asplundia alata Harl.		ME			
Eviodanthus funifer (Poit) Lindm.				CR, FI	
Thorocarpus bissectus (Vell.) Harl.	CR, FI				
Dioscoreaceae					
Dioscorea cf. *polygonoides* H.&B. ex Willd.			ME		
Dioscorea samydea K. von Mart. ex Griseb.			ME		
Dioscorea trifida L. f.	FO			FO	FO
Fabaceae					
Lonchocarpus nicou (Aubl.) DC.	FS, PO		ME	FS, PO	FS, PO
Vigna caracalla (L.) Verdc.			ME		
Gesneriaceae					
Besleria aggregata (K. von Mart.) Hanst.			ME		
Codonanthe sp.		ME			
Codonanthopsis dissimulata (Moore) Wiehler				ME	
Columnea ericae Mansf.			ME		
Columnea sp.			ME		
Dalbergaria picata (Karsten) Wiehler				PE	
Dalbergaria rubracuta Wiehler		ME			
Dalbergaria sp.		ME			
Drymonia coriacea (Oerst. ex Hanst.) Wiehler				ME	
Drymonia sp.		ME			
Hymenophyllaceae					
Trichomanes membranaceum L.	ME				
Loganiaceae					
Strychnos peckii B. L. Robinson M 134	HU, PO		ME		
Strychnos darienensis Seemann	HU, PO				
Strychnos erichsonii R. Schomb.	HU, PO				
Strychnos jobertiana Baillon	HU, PO				
Strychnos toxifera R. Schomb. ex Bentham	HU, PO				
Loranthaceae					
Oryctanthus florulentus (Rich.) van Tieg.		ME			
Phthirusa pyrifolia (HBK) Eichler		ME			
Psittacanthus cucullaris (Lam.) Blume		ME			
Malpighiaceae					
Banisteriopsis caapi (Spr. ex Griseb.) Morton	RM	RM	ME	ME	
Banisteriopsis longialata (Niedenzu) B. Gates	RM				
Banisteriopsis muricata (Cav.) Cuatrecasas					RM
Diplopterys cabrerana (Cuatrec.) Gates			ME	RM	
Hiraea sp.					FO
Marcgraviaceae					
Marcgravia sp.		ME			
Marcgravia sp.					FO, FR
Souroubea sp.					CR, HU
Genus indet.		ME			
Melastomataceae					
Blakea rosea (R.&P.) D. Don				ME	

APPENDIX B. Continued.

Species by family	Indigenous group				
	COF	QU1	QU2	SEC	WAO
Menispermaceae					
Abuta rufescens Aubl.	HU, PO		ME		
Anomospermum chloranthum Diels					HU, PO
Chondrodendron tecunarum Barneby & Krukoff	HU, PO				
Monimiaceae					
Siparuna sp.					ME
Orchidaceae					
Dichaea muricata (Sw.) Lindl.	ME				
Maxillaria rufescens Lindl.			ME		
Oncidium pusillum (L.) Reichb. f.	ME				
Phragmipedium sp.	ME				
Schomburgkia crispa Lindl.			ME		
Passifloraceae					
Passiflora riparia Martius	FO				
Passiflora foetida L.	FO				
Passiflora vitifolia H.B.K.		FO			
Passiflora sp.		FO			
Piperaceae					
Peperomia sp.		ME			
Peperomia sp.		ME			
Sapindaceae					
Paullinia bracteosa Radlk.				FO	
Paullinia yoco R. E. Schultes & Killip	RM			RM	
Paullinia sp.	FO				
Serjania inflata Poeppig & Endlicher			ME		
Serjania sp.	ME				
Selaginellaceae					
Selaginella exaltata (Kze.) Spring.		RM		CR	
Selaginella mortoniana Crabbe & Jermy		ME			
Selaginella sp.			ME		
Smilacaceae					
Smilax sp.		ME			
Solanaceae					
Solanum diffusum R.&P.				ME	
Urticaceae					
Urera baccifera (L.) Gaudich.		ME		ME, MI	ME, MI
Urera caracasana (Jacquin) Grisebach			ME	ME	
Verbenaceae					
Petraea maynensis Huber			ME		
Viscaceae					
Phoradendron crassifolium (DC.) Eichler		ME			
Vitaceae					
Cissus erosa L. C. Richard		ME			
Cissus sp.		ME			
Family indet.					
Genus indet.					ME