USE OF NATIVE TREE SPECIES BY AN HISPANIC COMMUNITY IN PANAMA[1]

SALOMÓN AGUILAR AND RICHARD CONDIT

Aguilar, Salomón and Richard Condit *(Center for Tropical Forest Science, Smithsonian Tropical Research Institute, Unit 0948, APO AA 34002-0948 USA; fax 507-212-8148 (Panama); email ctfs@tivoli.si.edu).* USE OF NATIVE TREE SPECIES BY AN HISPANIC COMMUNITY IN PANAMA. *Economic Botany 55(2):223–235, 2001.* *We investigated the use of plants collected in the wild by a small farming community in Central Panama to document the importance of noncultivated plants by tropical, nonforest-dwelling, nonindigenous people. We visited the community to observe what wood was used to build houses and interviewed local people about medicinal and edible plants collected in the wild state. The community reported use of 119 noncultivated plant species, including 108 tree species, three shrubs, two herbs, four lianas, and two vines. The majority (71) of the species were used for building homes. Other products built with wood collected in the wild were diverse kinds of tools, containers, cages, and fences. The second most important use of wild plants, in terms of number of species, was firewood, for which 40 species were mentioned by the community. Other uses included fruit for human consumption (20 species). Most of the species (82 of 119) were collected in secondary forests near the community, whereas another large group (47 species) were collected in mature forest. Fewer species were harvested in shrubby regrowth or from isolated trees in farm land. Nearly all the species (111 of 119) were native to the area, and never cultivated locally, but 15 species were considered especially valuable, and were often protected when found as juveniles. Only six of the species are commonly used in reforestation programs in Panama. We conclude that even hispanic communities in tropical Latin America, living outside the forest, with no Amerindian inhabitants, make frequent use of the great diversity of trees native to the region.*

Key Words: native trees; Panama; local plant uses; Hispanic community.

Forests contain many resources of economic value, such as seeds, fruits, medicine, or wood. Many of these values remain undocumented because the products are used locally, never entering national or international markets. For many conservationists, it is important to document these resources to provide more complete information on the value of forests. Although there are many studies on tropical forest use among indigenous peoples in the Americas (Armella and Giralda 1980; Forero Pinto 1980; Hazleett 1986; Herrera 1991), and more regarding commercially important woods (Record and Hess 1943; Allen 1964), there has been little work on Hispanic colonists who do not depend mainly on forest resources for their livelihood. Do these people have an interest in native plant resources?

In Panama, these colonists exert a strong pressure on forested areas of the Panama Canal watershed. For Panama's government, the protection of these forests is of great importance for maintaining the water supply of the Canal (Heckadon et al. 1999; Condit et al. 2001). Also, the Smithsonian Institution, a research arm of the United States government, maintains near the Canal one of the oldest reserves in the world for tropical forest research—the Barro Colorado Nature Monument (Rubinoff and Leigh 1990). To improve the information base available for the management of the watershed and the protection of the Monument, we have started several agroforestry and socioeconomic studies in the area, including this study on forest resources used by inhabitants of a community named Las Pavas, close to the monument and immediately outside the Reverted Zone, formerly known as the Panama Canal Zone (Fig. 1).

We focus this study on uses of plants that are collected in the wild state, that is, plants regenerating on their own as opposed to those deliberately cultivated. The principal source of these

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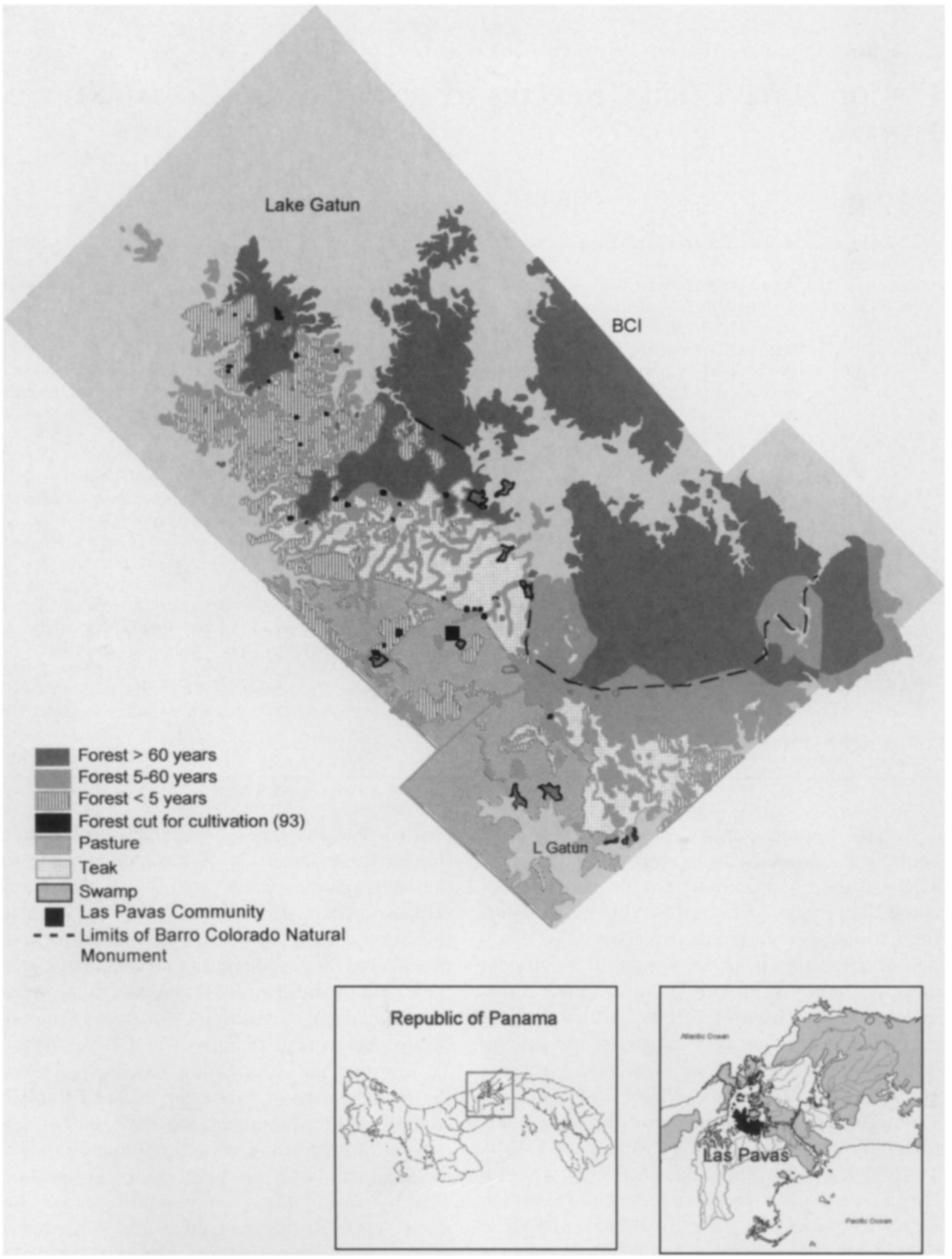

Fig. 1. Map of the Las Pavas region. The two small maps locate the area within Panama and within the Panama Canal region. The small map on the right has forested areas in light gray and nonforest in white; a closed line indicates the Panama Canal watershed (see Condit et al., 2001). On the large map, the town is indicated by a large black square. North is up on all maps. The pasture dominating in the southwest part of the map is on private land, and the Reverted Zone is between this and the Barro Colorado Nature Monument (the boundary between private land and Reverted Zone can be seen just north and east of the town as a clear line

plants would be the forest, but also, we considered plants that occur naturally in shrubland and pasture. Most of the plants collected in the wild are native to the area, but there are some exotics that have escaped and grow without cultivation.

Study Area

Las Pavas is about midway between Atlantic and Pacific Oceans, in central Panama, just west of the Panama Canal and in the Canal's watershed, at 09°06′ N, 79°53′ W (Fig. 1). The area is <150 m in elevation on mostly rolling terrain. The climate is humid but seasonal, with 2500 mm of precipitation annually, falling mainly between May and December, with a strong dry season between December and April (Leigh et al. 1990; Windsor et al. 1990).

Las Pavas is adjacent to the Barro Colorado Nature Monument (Fig. 1). This monument contains 5900 ha of completely protected forest, bordered by the Reverted Zone that was U.S. territory until 1977, when it reverted to Panama under the Carter-Torrijos Treaty. Las Pavas is located on private lands immediately outside of the Reverted Zone (Fig. 1).

Vegetation around Las Pavas corresponds with the three political regions (Fig. 1). First is the private land outside the Reverted Zone, mostly pasture owned in abstentia by people who live in larger cities nearby. Among these large farms are small holdings of the local farmers. The second region is the Reverted Zone, owned and managed by the Panamanian government, until recently a sea of the African grass *Saccharum spontaneum* L. In 1998, though, a Swiss timber company was granted a concession to establish a teak (*Tectona grandis* L.*f.*) plantation on 3500 ha of *Saccharum* grassland in the Reverted Zone near Las Pavas, and by 2004 most of the *Saccharum* grassland will be replaced by teak. There are small ribbons and islands of native vegetation within the teak plantations (Fig. 1), and these have been largely protected. Prior to the teak plantation, many people from Las Pavas cultivated within the Reverted Zone with annual permits granted by the Panamanian Environmental Authority (ANAM). Forest cutting was always illegal, but between 1977 and 1994, almost all the forest was eliminated (Fig. 1 shows sites cleared illegally in 1993 for cultivation). Farming is no longer permitted in the Reverted Zone. The third region near Las Pavas is the Barro Colorado Nature Monument, which is well-protected forest (Rubinoff and Leigh 1990).

The community at Las Pavas was established in the 1930s, mainly by immigrants from provinces to the west: Cocle, Herrera, and Los Santos (Herrera 1984). Their standard of living is low; the town has neither electricity nor running water, and most residents depend on subsistence agriculture. They plant crops in small plots adjacent to their homes, or until recently, in the Reverted Zone. Few have cash to buy much construction material or other equipment.

Methods

Most of our work was conducted during a three month period, July–September 1992, but we have continued visiting the village since. Information was obtained by consulting with 40 families of the area, mostly husbands, but women participated in some of the interviews at home. The subjects were selected by consulting with a researcher who had worked on an experimental farm in Las Pavas for several years. He knew many locals, and recommended several who had ethnobotanic experience. Because the entire community of Las Pavas comprises only about 60 families (Herrera 1984), our sample was quite extensive. All interviews were carried out by the senior author, who was brought up on a farm in a similar rural region of Panama, and is thus familiar with local customs and ethnobotanic practices.

The first part of each interview was carried out in the subject's home. We asked what plant species were used in house construction, for tools, firewood, food, or medicine. Most of these questions were accompanied by a discussion of

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between pasture and teak plantation). BCI is Barro Colorado Island, part of the Nature Monument. The map was created from aerial photos taken in 1993 along with our extensive walks throughout the area. In 1993, the nonforested sections of the Reverted Zone were covered entirely in the tall grass, *Saccharum spontaneum,* but now this is being replaced by teak plantation. The distance from Las Pavas to the nearest mature forest (dark gray) is 2.5 km.

a specific object, for example, "What species was used to make this beam?" We also asked from where the information about certain unusual or specialized uses was acquired. The interview was carried out informally, with no paper or pencil, because we felt this would lead to a more relaxed and open setting. The discussions lasted about 30 minutes, and notes were taken as soon as they ended.

At the end of the in-home interview, the second phase was arranged for a later day. This part of the interview involved walking with each subject from Las Pavas through pasture and farm land and into the forest at the edge of the Barro Colorado Nature Monument. As we started the walk, we asked the subject to point out plants that were mentioned during the first part of the interview. When plants were observed, we discussed how they were collected, and inquired about local names for the species. On a few occasions, we mentioned uses of certain plants from our experience, and asked whether the subject also used the plant. This led to a few positive responses, however, nearly all plant-uses recorded here were mentioned first by our subjects. In addition, while in the field we asked about each species where it was usually collected: in mature forests of Barro Colorado Nature Monument (>60 yr old), secondary forests adjacent to the Monument (<60 yr old), shrublands (trees < 5 yr old), isolated trees in grassland, or trees around cultivated areas. Collection within the Nature Monument would be illegal, nevertheless, several subjects indicated that they did so.

If we were not familiar with a plant observed while walking, we collected it for identification using the floras of the region (Croat 1978; D'Arcy 1987; Woodson and Scherry 1943–1980) or to compare with samples at the herbaria of the Smithsonian Tropical Research Institute or the University of Panama. A few specimens could not be identified fully to species, usually because there are several similar species in the same genus, and we did not have reproductive parts. Names used here match those in the checklist of the Flora of Panama (D'Arcy 1987) as updated by M. Correa and C. Galdames at the Smithsonian Tropical Research Institute.

Most of these field interviews were carried out with one subject at a time, but in a few cases, we walked with two people. Wives never joined these walks. The field portion generally lasted three to five hours.

We intended these interviews to provide a comprehensive list of the ways that native plant species are used in and around Las Pavas, however, the data are qualitative in terms of how frequently plants are collected and in what volume. Rigorous quantitative data on how much is collected, or on the market value of items, would have been a much larger project. A concern we have with the results is that subjects might have reported plants whose uses they only knew second-hand, not from their own experience. We cannot separate these cases, however, our approach of asking people to identify the plants used in manufacture of objects that they had in their houses was designed to focus attention on first-hand experience.

RESULTS

SPECIES

Our informants identified 119 plant species, growing in a wild state, that were useful to them in some way (Table 1): 108 tree species, three shrubs, two grasses, four lianas, and two vines. Among the trees, 53 were large (≥20 m in maximum height), 23 medium-sized (10–20 m height), and 32 small (4–10 m height; see Hubbell and Foster 1986). Nearly all were native to the region, the exceptions being *Bambusa vulgaris* Schrad. (bamboo), *Mangifera indica* L. (mango), *Syzygium jambos* (L.) Alston, *Anacardium occidentale* L. (cashew), *Crescentia cujete* L. (calabash), *Gliricidia sepium* (Jacq.) Steud., *Psidium guajava* L. (guava), and *Spondias purpurea* L.; each has escaped cultivation and was collected by the campesinos growing wild. The first three are native to the old world, while the last five are native to the new world and probably Central America, but in our area they only appear in cultivation or near human settlements.

USES

House construction was the dominant use of the plants collected, especially roof construction (Table 2). Seventy-one tree species of all sizes, including palms and small trees, were used for building. Informants were specific about which species could be used for various parts of a house—walls, beams, columns, roofs—and this is documented in Tables 1 and 2. Durability, resistance, and availability were given as the most

important characteristics for construction material.

A typical house at Las Pavas has a dimension of 6 m × 4 m. It requires four columns, 2.5 m in height, made from 5–10-yr-old *Colubrina glandulosa* Perkins, and 45–50 poles for the crosspieces supporting the thatch roof, made from 2–5-yr-old *Colubrina glandulosa* or *Coutarea hexandra* (Jacq.) K. Schum. Both species have strong and resistant wood, are common in the region, and are easy to gather. The roof of this house would be covered with 144 leaves of the palm, *Attalea butyracea* (Mutis ex L.*f.*) *J.G.W. Boer,* and the walls built from 10–15 trunks of gira (*Socratea exorrhiza* H. Wendl.) or trupa (*Oenocarpus mapora* Karst.), both also palms.

The second most important use in terms of the number of species mentioned was firewood (Table 2), for which 40 tree species were reported, mainly for use in the kitchen. Important characteristics mentioned for firewood included the capacity to burn when the wood was still green (that is, freshly cut), to hold heat for a long time, and to produce little ash. In third place in terms of species number was wood to build fences (27 species). Fence stakes were either made from dead or living tree trunks or branches, generally 5 cm or more in diameter. Live fences were made from 13 species by inserting trunks or branches directly into the ground; the stake then sprouts and grows a small crown of leaves (Tables 1, 2).

Twenty one species were cited for the manufacture of instruments or tools. Handles for axes, hammers, hoes, picks, etc., were common uses mentioned. Other more specialized instruments included receptacles made from calabash fruit (*Crescentia cujete*), cages made from the petioles of the leaves of *Schefflera morototoni* (Aubl.) Maguire, Steyerm. & Frodin, yokes (for oxen), thills (horizontal poles attaching the yoke to the cart), large mortars and pestels for husking rice, trays for separating the husk from the grain, and tables for grinding. Particular species were cited as useful for each of these instruments (Table 1).

Nineteen species were identified as producing fruit for human consumption (Tables 1, 2). Four of these were cultivated trees—mango (*Mangifera indica*), cashew (*Anacardium occidentale*), guava (*Psidium guajava*), and the wild plum (*Spondias purpurea*). The rest were native to the region. A native fruit of great importance is the nance (*Byrsonima crassifolia* H.B.K.), a very common small tree of pasture land throughout the area.

The least-frequently mentioned plant products, in terms of species numbers, were fibers and medicines. Thirteen species, five lianas and eight trees, were cited as useful sources of fibers to make hats, ropes, or cords (Tables 1, 2). Fibers were extracted from the bark or the trunk, or in the case of *Carludovica palmata* R. & P. (the Panama hat palm), from the young leaves. Trunks or leaves are typically set in water or mud to decompose before fibers are plucked. Finally, nine species, including a vine, were mentioned as medicinal (Table 1, 2). Most typically, leaves or bark were steeped into teas for treating colds, fever, or insect or snake bites.

Preferred Species

Las Pavas' campesinos indicated 15 species as especially valuable (marked with double asterisks in Table 1). For construction, these were species with hard but easily-milled wood. For fuel, favored species burned well and produced little smoke or ash. Only one of the 15 had valuable fruits and none had medicinal value. Some of these species were valuable due to the diversity of uses reported and also due to their high commercial value; especially nance (*Byrsonima crassifolia*) used to build fences, as firewood, and as fruit; and, the laurel (*Cordia alliodora* Cham.) used as firewood and for all sorts of construction. When these 15 species where found as young individuals close to a dwelling, they were protected, but no one reported them as being cultivated.

We marked with single asterisks 30 additional species in Table 1 which were especially important for campesinos in Las Pavas. These indicate our qualitative impression about the species most frequently used in the community.

Sources of Plants Collected

The largest number of species were reported to be extracted from secondary forests (82 species) and mature forest (47 species; see Table 3). Fifty-four of the species were restricted to one of the categories, mainly the 27 species from secondary forest and the 8 from mature forest (Table 3). Some species were only available in open or cultivated areas (Table 3). All sites listed

TABLE 1. TREE SPECIES UTILIZED BY THE RESIDENTS OF LAS PAVAS. THE COMMON NAME IS THE NAME MOST FREQUENTLY USED IN LAS PAVAS; FOR SOME SPECIES THERE ARE DIFFERENT NAMES IN OTHER PARTS OF PANAMA. SOURCE INDICATES THE HABITAT FROM WHICH EACH SPECIES WAS COLLECTED: 1 = FOREST < 5 YEARS OLD; 2 = FOREST 5–60 YEARS OLD; 3 = FOREST > 60 YEARS OLD; 4 = CULTIVATED AREAS; 5 = PASTURES WITH SOME ISOLATED TREES; 6 = WETLANDS; 7 = OPEN AREAS IN THE FOREST; 8 = LIVING FENCES; 9 = STREAMBANKS. CODES FOR PLANT USES: CONST = CONSTRUCTION (W = WALLS, B = BEAMS, C = COLUMNS, R = ROOF); TOOL = TOOLS (M = MORTAR AND P = PESTLE FOR HUSKING RICE, TR = TRAY FOR SEPARATING HUSK FROM RICE, H = TOOL HANDLES, C = CAGE, Y = YOKE, TH = THILL, J = JUG); FENCE = FENCEPOSTS (D = NON-LIVING, L = LIVE); FIRE = FUELWOOD; FRUIT FOR HUMAN CONSUMPTION; MED = MEDICINAL; FIBER FOR CORD OR CLOTHING. SPECIES MARKED WITH A DOUBLE-ASTERISK ARE PROTECTED BY LAS PAVAS RESIDENTS WHEN FOUND AS SAPLINGS BECAUSE OF THEIR GREAT USEFULNESS. SPECIES MARKED WITH ONE ASTERISK ARE OTHERS HEAVILY USED IN THE COMMUNITY.

Latin name	Common name	Family	Source	Const	Tool	Fence	Fire	Fruit	Med	Fiber
*Alibertia edulis**	madroño	Rubiaceae	1, 2	R	H		x	x		
Alseis blackiana	mameicillo	Rubiaceae	3	R			x			
*Amaioua corymbosa**	madroño de montaña	Rubiaceae	2, 3	R	H		x			
*Anacardium excelsum***	espave	Anacardiaceae	2, 3, 5	W	M					
Anacardium occidentale	marañon	Anacardiaceae	4				x			
Annona spraguei	negrito	Annonaceae	1, 2, 5				x			
Apeiba tibourbou	cortezo	Tiliaceae	1, 2							x
Apeiba membranacea	cortezo	Tiliaceae	1, 2							x
Ardisia fendleri	canelo de montaña	Myrsinaceae	2	R, B			x			
Ardisia guianensis	mangle boton	Myrsinaceae	2	B						
Astrocaryum standleyanum	chunga palma negra	Palmae	2, 3	C, R						
*Attalea butyracea**	palma real	Palmae	5	R					x	
Bactris barronis	caña brava	Palmae	2, 3	R						
Bactris coloradonis	caña brava	Palmae	2, 3	R						
Bactris gasipaes	pixbae	Palmae	4	R				x		
*Bambusa vulgaris**	bambu	Graminae	4	W						
*Banara guianensis**	pica lengua	Flacourtiaceae	2	R			x			
Bauhinia guianensis	escalera de mono	Leguminosae	2, 3							x
Brosimum sp.	casique	Moraceae	3	C						
Bursera simarouba	almácigo	Burseraceae	2, 5			V				
Bursera tomentosa		Burseraceae	1, 2			V				
*Byrsonima crassifolia***	nance	Malpighiaceae	4, 5			M	x	x		
*Brysonima spicata***	nancillo	Malpighiaceae	2	R, B			x			
Calophyllum longifolium	maria	Guttiferae	3	W						
Calycolpus warzewiczianus		Myrtaceae	2				x			

TABLE 1. CONTINUED.

Latin name	Common name	Family	Source	Const	Tool	Fence	Fire	Fruit	Med	Fiber
Calycophyllum candidissimum	madroño	Rubiaceae	2, 3	R						
Calyptranthes hylobates	gasparillo	Myrtaceae	1, 2	R						
Carludovica palmata	bellota	Cyclanthaceae	7							x
*Casearia guianensis**	coloraito	Flacourtiaceae	2	R			x			
*Casearia commersoniana***	coloraito	Flacourtiaceae	2	R			x			
*Casearia sylvestris**	coloraito	Flacourtiaceae	2	R			x			
*Cedrela odorata***	cedro	Meliaceae	2, 5	W						
Ceiba pentandra	ceibo bongo	Bombacaceae	3		Tr					
*Chrysophyllum argenteum**	caimito de mono	Sapotaceae	2, 3	C	H	M		x		
*Chrysophyllum cainito**	caimito	Sapotaceae	3, 5	B	P	M		x		
Coccoloba manzanillensis	uvita de parra	Polygonaceae	2, 3					x		
Cochlospermum vitifolium	poro poro	Cochlospermaceae	1, 5			V			x	
*Colubrina glandulosa***	carbonero	Rhamnaceae	2, 5	C, R		M	x			
Copaifera aromatica	cabimo	Leguminosae	?	B						
*Cordia alliodora***	laurel negro	Boraginaceae	2	R, C, W	Th, H	M	x			
Cordia bicolor	laurel blanco	Boraginaceae	2	R, W						
Cordia sp.	mala sombra	Boraginaceae	2							
Costus villosissimus	caña agria	Costaceae	9			M				
*Coutarea hexandra***	azulejo	Rubiaceae	2	R			x			
Crescentia cujete	calabaso	Bignoniaceae	4		Y, J					
*Croton draco**	algodoncillo	Euphorbiaceae	2, 5	B			x			
Cupania rufescens	guabo pelú	Sapindaceae	2	R						
*Cydista aequinoctialis**	bejuco colorado	Bignoniaceae	1, 2							x
Cydista sp.*	bejuco verde	Bignoniaceae	1, 2							x
Desmoncus orthoacanthus	matamba	Palmae	2, 3							x
Desmopsis panamensis	llallito	Annonaceae	2, 3	R			x			x
*Dialium guianensis**	tamarindo	Leguminosae	2, 5	C	H					
Dioscorea sp.	raiz de la india	Dioscoreaceae	2						x	
Diphysa robinioides	macano	Leguminosae	5	C						
Dipteryx panamensis	almendro	Leguminosae	3, 5	B		M				
Elaeis oleifera	palma negrita aceitera	Palmae	6						x	
Enterolobium cyclocarpum	corotú	Leguminosae	2, 3, 5		Tr					
Enterolobium schomburgkii	guabino	Leguminosae	3	B						
*Erythrina fusca**	machetitopito	Leguminosae	8			V				
Erythroxylum citrifolium	alcarreto	Erythroxylaceae	2	R						
Eugenia venezuelensis	guayabo de montaña	Myrtaceae	1, 2		H		x			

TABLE 1. CONTINUED.

Latin name	Common name	Family	Source	Const	Tool	Fence	Fire	Fruit	Med	Fiber
*Faramea occidentalis**	huesito jazmin	Rubiaceae	2, 3		H		x			
Ficus bullenei	higuerón negro	Moraceae	8			V				
*Genipa americana**	jagua	Rubiaceae	2, 5	B	H, P			x		
*Gliricidia sepium**	balo	Leguminosae	8	C		M, V	x			
Guatteria dumetorum	sigua negro	Annonaceae	2, 3	B						
Guazuma ulmifolia	guácimo	Sterculiaceae	1, 2				x			
Gurania sp.*	Tripa de pollo	Cucurbitaceae	2							x
*Hirtella racemosa**	garrapato de montaña	Chrysobalanaceae	2	R						
Hyeronima alcheorneoides	piedro pilón	Euphorbiaceae	3			V	x			
Hymenaea courbaril	algarrobo	Leguminosae	2, 3, 5					x	x	
Inga cocleensis	guabito	Leguminosae	2, 5				x			
Inga spectabilis	guaba machete	Leguminosae	3, 9					x		
Inga vera	guabita cansaboca	Leguminosae	2, 5				x	x		
Jatropha curcas	coquillo	Euphorbiaceae	8			V			x	
Lacistema aggregatum	huesito	Lacistemaceae	2	R			x			
Licania hypoleuca	corocillo	Chrysobalanaceae	2, 3	R, B						
Licania platypus	zapote	Chrysobalanaceae	2, 3					x		
*Lindackeria laurina**	escribano	Flacourtiaceae	2	R			x			
Lonchocarpus latifolia	zorro	Leguminosae	2, 3, 5			M				
Mangifera indica	mango	Anacardiaceae	4		Y, M			x		
Manilkara zapota	níspero	Sapotaceae	2, 3	C				x		
*Margaritaria nobilis**	clavito	Euphorbiaceae	2	R, B			x			
*Matayba scrobiculata**	quiebra macheta matill	Sapindaceae	1, 2	R			x			
*Miconia argentea***	papelillo dos cara	Melastomataceae	2, 5	B		M	x			
*Oenocarpus mapora**	Trupa maquenque	Palmae	7	W				x		
Ormosia macrocalyx	cabresto	Legumionsae	2, 3, 5	C						
*Pachira quinata***	cedro espino	Bombacaceae	2, 3, 5	W, B		V				
Pachira sessilis	yuco de monte	Bombacaceae	2, 5	W		V				
*Pera arborea**	sapito	Euphorbiaceae	2	R			x			
*Phoebe cinnamomifolia***	sigua blanca	Lauraceae	2	C, B			x			
Posoqueria latifolia	teta de vieja	Rubiaceae	3	R			x			
*Prioria copaifera**	cativo	Leguminosae	3, 6, 9	W						x
Pseudobombax septenatum	barrigón	Bombacaceae	2, 3, 5			V				
Psidium guajava	guayaba	Myrtaceae	1, 2, 5				x	x		

TABLE 1. CONTINUED.

Latin name	Common name	Family	Source	Const	Tool	Fence	Fire	Fruit	Med	Fiber
Quassia amara	guabito amargo	Simaroubaceae	2, 3, 5			M				
Schefflera morototoni	mangabé	Araliaceae	2		C					
*Siparuna guianensis***	pasmo hediondo	Monimiaceae	1, 9			M				
Sloanea zuliaensis	achotillo	Elaecarpaceae	2				x			
Socratea exorrhiza	gira	Palmae	2, 3	W						
*Spondias mombin**	jobo	Anacardiaceae	5			V		x		
*Spondias purpurea**	ciruela	Anacardiaceae	4			V		x		
Sterculia apetala	arbol panamá	Sterculiaceae	2, 3		Tr					
Swartzia simplex	cutarro naranjillo	Leguminosae	2	R						
Symphonia globulifera	cerillo	Guttiferae	2, 9						x	
Syzygium jambos	poma rosa	Myrtaceae	9				x	x		
*Tabebuia guayacan***	guayacán	Bignoniaceae	3, 5	C	H	M				
*Tabebuia rosea***	roble	Bignoniaceae	3, 5	W		M				
*Terminalia amazonia***	amarillo	Combretaceae	2, 3, 5	R, C, W		M	x			
Terminalia oblonga	guayavillo	Combretaceae	2, 3, 5	R, C, W						
*Tetragastris panamensis**	secuara	Burseraceae	2, 3	R, B						
Trattinnickia aspera	caraño blanco	Burseraceae	2, 3		M				x	
Trichilia tuberculata	alfajía colorao	Meliaceae	3	B	Th, H					
Vochysia ferruginea	botarama	Vochysiaceae	2, 3	W						
*Xylopia aromatica**	malagueto	Annonaceae	2	R, B			x			x
*Xylopia frutescens**	malagueto macho	Annonaceae	2	R	H		x			x
Xylopia macrantha	cachito	Annonaceae	2	R			x			
Zanthoxylum ekmanii	arcabú tachuelo	Rutaceae	2, 3	W						
Zanthoxylum panamense	arcabú tachuelo	Rutaceae	2, 3	W						

TABLE 2. PLANT USES IDENTIFIED BY RESIDENTS OF LAS PAVAS, AND THE NUMBER OF SPECIES DESCRIBED IN EACH CATEGORY OF USE. IN THREE CATEGORIES THERE ARE SUBCATEGORIES LISTED; THE SPECIES TOTAL IN CATEGORIES IS LESS THAN THE SUM OF THE SUBCATEGORIES BECAUSE MANY SPECIES HAD MORE THAN ONE USE.

Use	Number of species
Total for house construction	71
Roof	39
Central beams	18
Walls	17
Poles	14
Total for fuelwoods	40
Total for fences	27
Non-living fences	15
Live fences	13
Total for instruments	21
Tool handles	10
Mortar (for breaking husk off rice)	3
Pestle (for breaking husk off rice)	2
Tray (for separating rice from husk)	3
Yoke	3
Cage	1
Thill (of wagon)	1
Container	1
Total for fruit	19
Total for fiber	13
Total for medicine	9

in Table 3 were accesible <3 km from the village (Fig. 1).

In nearly all cases, plants were transported home by the subject. Larger trees were nearly always carried with assistance from neighbors. Some people in Las Pavas have horses, and a few of our subjects mentioned use of horses for transport on occasion.

SOURCES OF KNOWLEDGE

Most people reported having learned about specific plant-uses from their parents (specifically, fathers). Several mentioned learning from neighbors or other townspeople. No one mentioned any information learned from Amerindian groups.

DISCUSSION

This small farming community uses a high diversity of trees collected in the wild state. It is a recently formed community, with no Native Americans. Nevertheless, the townspeople of Las Pavas reported use of more than 100 native species and had sophisticated knowledge about which species to use in what circumstances. For the most part, this information has probably accumulated through experience and been passed on from generation to generation, since the hispanic settlement of Panama.

TABLE 3. COLLECTING AREAS CLOSE TO LAS PAVAS. TOTAL SPECIES INDICATES THE NUMBER OF SPECIES COLLECTED IN EACH AREA. RESTRICTED SPECIES INDICATES THE NUMBER COLLECTED ONLY IN THAT AREA.

Collection habitat	Total species	Restricted species
Forest < 5 years old	14	0
Forest 5–60 years old	82	27
Forest > 60 years	47	8
Pasture with isolated trees	21	3
Wetlands	2	1
Open areas in the forest	2	2
River or streambanks	6	2
Live fences	4	4

Our study shows that the most important uses of wild trees, at least in terms of the number of species used, are construction of houses and tools. According to Pena Franco (1990), in Las Pavas and two adjacent villages, 67% of the houses have roofs constructed with plant products (leaves of *Attalea butyracea*), 60% have walls made from *Socratea exorrhiza,* and 34% have wood floors. At Las Pavas, the other important use of wood is as a fuel source, with 40 different species cited. The importance of wood in rural communities is well known in Panama, for example, Las Pavas and two neighboring villages use 450 metric tons of wood per year (Pena Franco 1990). This represents about 1200 trees of the small stature typical in young secondary forest aroung the towns (10 cm diameter, 10 m tall). Obviously, Las Pavas depends largely on native trees that grow near the village. Changes in the abundance of tree resources would be important for the community.

In spite of the interest in and the importance of native trees in Las Pavas, there is almost no interest in reforestation with native trees in Panama nor in Latin America in general. More than 90% of the reforested hectares in Panama have been planted with exotic species, particularly *Pinus caribea* Morelet (INRENARE 1990; Arcia

1994). In the vicinity of Las Pavas, 20 tree species are cultivated (six mentioned in Table 1), almost all exotics, especially *Mangifera indica, Cocos nucifera* L., *Citrus* sp., *Tectona grandis, Pinus caribea,* and *Acacia mangium* Willd. The great diversity of native tree species which have specific construction uses in Las Pavas suggest that a handful of exotic species cannot be satisfactory replacements.

The lack of reforestation programs with native trees is due in large part to a lack of silvicultural information (Condit et al. 1993a), and our studies indicate the importance of examining more native species in Panama. We have started research on the use of native trees in plantations on deforested lands around Las Pavas (Condit et al. 1994). We worked with local farmers to plant seedlings of 15 native species on private land, under various fertilization and weed-clearing treatments (Condit et al. 1994). In addition, we have begun producing pamphlets on the propagation of native trees (Sautu et al. 1999). Species were selected for these studies based first on this survey at Las Pavas, and on growth data in a natural forest plot on Barro Colorado Island (Hubbell and Foster 1983, 1992; Condit et al. 1993a,b). In adddition, we have been studying the natural regeneration of trees in abandoned grassland (Hooper et al. n.d.).

We compared our results on native plant uses in Las Pavas with several studies on native tree use and ethnobotany in Central and South America (Allen 1964; Ayensu 1981; Cabrera 1973; Dickinson et al. 1949; Duke 1968, 1970, 1985; Escobar 1972; Forero Pinto 1980; Garces 1972; Garibaldi Escobar 1982; Hazlett 1986; Herrera 1991; Hess, Wangaard, and Dickinson 1950; Honeychurch 1986; Janzen 1983; Lorenzi 1992; Morton 1981; Patiño 1977; Pittier 1931; Pranz and Kallunki 1983; Record 1927a,b; Record and Hess 1943; Roig and Mesa 1974; Sarmiento 1983; Standley 1932; Wangaard, Stern, and Goodrich 1955; Williams 1981; Zamora Villalobos 1989). We found 71 of the species identified at Las Pavas were also mentioned in other inventories, and 53 of these had the same uses documented in both studies (although some of the 53 species had additional uses we did not find at Las Pavas). Eighteen species had a different use at Las Pavas than mentioned in other studies, and 48 of the 119 species in Table 1 had not been mentioned in previous ethnobotanical studies, including comprehensive documentations made by Williams (1981) and Duke (1968, 1970, 1985). This further indicates the value of native plant diversity for direct comsumption by rural Latin American people.

Las Pavas, however, contrasts with other studies in the importance of construction and firewood uses, and the lack of medicinal uses. Sixty percent of the species at Las Pavas were metioned for house construction, 34% for fuelwood, but only 8% as medicinal. In contrast, in a study in western Panama and Costa Rica, Hazlett (1986) identified 76 plant species used without cultivation by two villages, 14% of which for construction and 58% for medicine. Similarly, in Colombia, Armella and Giraldo (1980) identified 12% of the species for construction, 6% for fuel, and 59% as medicine. (We calculated percentages from a random subsample from Armalle and Giraldo's (1980) list of 351 species. We selected the first three species of each letter of the alphabetical list, eliminating cultivated species.) These other studies focused on indigenous groups, who ought to have longer traditions on medicinal and craft plants than hispanic populations. But some of the differences must indicate researchers' biases: Hazlett (1986) did not mention a single plant used for firewood, and surely Guaymi Indians burn wood.

The habitats where trees were collected in part reflect the types of land available near Las Pavas, but also indicates to some extent distribution of the species. The frequency of collection in secondary forest, <60 years in age, undoubtedly reflects the preponderance of this forest type in the Reverted Zone near Las Pavas. On the other hand, there were many more species collected in forest of any age (97 species in forest > 5yr old) than in open areas (46 species from grassland or forests < 5 yr), even though the land immediately around the village is nearly all grassland. This indicates the importance of forest to the community.

The destruction of these forests would clearly change life in Las Pavas. We have documented forest cover reduction in the Reverted Zone between Las Pavas and Barro Colorado Nature Monument since 1977 (Condit et al. 1994). Each year the inhabitants will have to walk greater distances to locate forest outside of the Monument. When the forests disappear, the diversity of species available and the accompanying diversity of practical uses will decline. This situ-

ation demands an increase in reforestation with a large variety of trees useful to local people.

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