Management of *Astrocaryum standleyanum* (Arecaceae) for Handicraft Production in Colombia

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Research

Abstract

We studied use and management of *Astrocaryum standleyanum* L.H. Bailey among the Wounaan people at the Pacific Coast of Colombia between 2009 and 2011, with the intention of generating recommendations for a sustainable management of the palm. We used ethnobotanical techniques and established plots to monitor palm populations. *A. standleyanum* grows in forest and cultivated fields near the Wounaan villages, where leaves are harvested non-destructively by using a **medialuna** mounted on a pole. Fiber is then extracted from the epidermis and mesophyll of the leaflets, processed, dyed, and used to produce baskets woven with the coiled technique. The handicrafts are marketed through middlemen or in handicraft fairs, and they are the major source of cash income for the Wounaan. As a result of the now abandoned malpractice of cutting down palms to obtain the fiber, there is a low number of adult palms, but the population structure shows signs of recovery. Integration of traditional practices with non-destructive harvest techniques suggests that in this region it is possible to conserve both the palm and the artisanal activity, which represents a major line for the socioeconomic development for the Wounaan.

Resumen

Estudiamos el uso y manejo de la palma *Astrocaryum standleyanum* L.H. Bailey **entre los Wounaan del Bajo Río San Juan**, **en la Costa Pacífica de Colombia**. **La información se recopiló entre 2009 y 2011**, **con el fin de generar lineamientos para el manejo sostenible de la palma**. **Se emplearon técnicas etnobotánicas y se realizaron parcelas para censar y monitorear las poblaciones**. *A. standleyanum* **crece en los bosques y en las áreas de cultivo que circundan las comunidades indígenas**, **donde actualmente se cosecha de manera no destructiva**, **cortando el cogollo con cuchilla**. **Las indígenas obtienen la fibra extrayendo la epidermis y el mesofilo de los foliolos**, **luego la procesan**, **la tiñen y la emplean para elaborar jarrones y bandejas tejidos mediante la técnica de rollo**. **Los productos se comercializan a través de intermediarios y en ferias artesanales y son la principal fuente de ingresos para las familias**. **Como consecuencia de la práctica ya abandonada de derribar las palmas existe una baja proporción de palmas adultas en la población**, **pero la estructura poblacional muestra signos de recuperación**. **La integración de las prácticas tradicionales indígenas con técnicas de cosecha no destructivas**, **sugieren que en esta región se puede lograr la conservación de la especie y de la actividad artesanal**, **que representa un renglón importante para el desarrollo socioeconómico de los Wounaan**.

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Introduction

Human communities that inhabit tropical forests obtain fibers from several palm species. This has a strong impact on forest management practices and local economies (Isaza 2011). One of the most important palm species for fiber production in Colombia is *A. standleyanum* (**güérregue**), a large, spiny palm that grows in wet forests from Costa Rica to Ecuador. In several areas along the Pacific coast of Panamá, Colombia and Ecuador, the youngest leaves of this palm are harvested to make handicrafts, which have an important market (Bernal 1992, Bernal *et al*. 2011, Borgtoft Pedersen 1994, Fadiman 2008, Linares *et al*. 2008, Valderrama 2011, Velásquez 2001).

While the traditional management of this species has been documented in Ecuador and Panama (Borgtoft Pedersen 1994, Fadiman 2008, Velásquez 2001), there is little published information on the subject in Colombia (Linares *et al*. 2008). Most extraction of *A. standleyanum* in Colombia is done by the Wounaan Indians and by Afro-Colombians of the lower San Juan river, in the Pacific lowlands. There, *A. standleyanum* populations have been decimated due to the former habit of cutting down the whole palm to harvest its leaves (Bernal *et al*. n.d., Linares *et al*. 2008, Valderrama 2011). In the last two decades, however, the use of cutting tools attached to a pole has been encouraged by authorities and other organizations (Bernal *et al*. n.d., Delgadillo 1996, Linares *et al*. 2008, Torres 2006). Likewise, a number of strategies for the management of *A. standleyanum* have been designed, including control of the intensity of extraction and integration of the palm into agroforestry systems (Artesanías de Colombia & Fundación FES 2001, CAMAWA 2001). All this has changed the management practices in most Wounaan communities. As a part of an ongoing project with the purpose of promoting sustainable harvest of *A. standleyanum*, we documented its current use and management in Wounaan communities along the lower San Juan river, and assessed the state of the palm populations.

Study Species

Astrocaryum standleyanum is a solitary palm, with a stem up to 12 m tall and 15-20 cm in diameter, provided with flattened, black, strong spines 12-18 cm long. The crown bears 12-18 leaves, each one up to 5.5 m long, with the pinnae arranged in several planes (Figure 1). It is a monoecious palm, with pistillate and staminate flowers in the same inflorescence. Fruits are obovoid, orange when mature, up to 5 cm long and 3.5 cm in diameter (Galeano & Bernal 2010). The species ranges from Costa Rica to western Ecuador. In Colombia it inhabits wet and *terra firme* forest in the Pacific lowlands, from Chocó to Nariño, and along the upper Sinú river up to 200 m above sea level (Galeano & Bernal 2010). Its fruits are an important food for wild fauna and its dispersal probably depends on them (Smythe 1989). Dispersers of *A. standleyanum* fruits include agoutis (*Dasyprocta punctata* Gray, 1842), squirrels (*Sciurus granatensis* Humboldt, 1811), pacas (*Agouti paca* L., 1766) and collared peccaries (*Tayassu tajacu* L., 1758). Smythe (1989) has shown that a severe reduction of the population of *A. standleyanum* in Barro Colorado, Panama, would cause a dramatic reduction in the populations of the agouti.

Besides the use of unexpanded leaves as a source of fiber, the stems of *A. standleyanum* are used in house construction, the developing leaves are eaten as palm hearts, the mesocarp as a raw fruit, and the endocarp is cut to make rings (Fadiman 2008, Forero 1980, Galeano & Bernal 2010, Hernández 2003, Linares *et al*. 2008, Patiño 1977).

Methods

Study area

Our study was conducted along the lower San Juan river in the Pacific lowlands of Colombia (3º 53'-4º 13' N, 77º 16'-77º32' W), the only area in Colombia where *A. standleyanum* is used as a source of fiber for handicraft production. The natural vegetation of the area is flooded or *terra firme* rain forest, and rivers are the major transportation routes. The closest large town is Buenaventura, which is Colombia's largest port on the Pacific, and the region's link to the rest of the country.

The Wounaan Indians, also known as Waunana, Noanamá, or Nonam, occupy the area along the lower San Juan river, and the smaller nearby rivers Docampadó, Togoromá, and Pichimá. Their territory comprises 1,895 km^2 (Arango & Sánchez 2004), and their language, Wounmeu, belongs to the Chocó linguistic family (Lewis 2009).

Data collection

We compiled and reviewed published and gray literature on the history of use and management of *A. standleyanum* in Colombia. In order to characterize the harvest, processing and marketing of *A. standleyanum*, we visited the region four times between 2009 and 2011, accompanying Wounaan families in all activities related to its use. Most observations were made in the village of Puerto Pizario (4°13'36"N; 77°16'18"W), but additional data were taken in the nearby villages Papayo, Burujón, San Bernardo, Guarataco, and Bellavista, as well as the Afro-Colombian village Cabeceras. In Puerto Pizario, we conducted nine semi-structured interviews with five women and four men, between the ages of 30 and 56. In the other villages, we conducted seven unstructured interviews. We also interviewed a Wounaan family that lives in Bogotá and a middleman that markets handicrafts. In order to assess the status of the *A. standleyanum* population, we established five plots of 50 x 20 m in Puerto Pizario, and all individuals of the palm in the plots were recorded and permanently

Figure 1. *Astrocaryum standleyanum* L.H. Bailey growing in Wounaan homegarden, along the lower San Juan river, Colombia.

tagged. Palms were classified according to their size as: seedlings (acaulescent with bifid leaves), juveniles (acaulescent with pinnate leaves), subadults (caulescent and non-reproductive) and adults (reproductive individuals). All harvested palms were followed during one year, in order to determine their leaf production rate. To do this, we marked the position of the youngest leaf on the stem and exactly one year later we counted the leaves produced after that.

Results

Harvest

Along the lower San Juan river spear leaves of *A. standleyanum* are harvested by the Wounaan and sometimes by Afro-Colombians. Whereas the Wounaan use the leaves to obtain fibers and to elaborate handicrafts, Afro-Colombians harvest them only to sell to the Wounaans. At least until 1995, the widespread practice was to cut down the palms (Gallego 1995). As a result of several awareness campaigns started in 1994 (Torres 2006), and after the introduction of appropriate harvest tools, most artisans have abandoned the destructive harvest (Artesanías de Colombia & Fundación FES 2001, Bernal *et al*. n.d., CAMAWA 2001). The most important step was the introduction of the **medialuna**, a curved, metallic blade that is fit at the end of a long pole, and makes it possible to cut the spear leaf without felling the palm. Although occasionally some harvesters still fell the palms, our own field work revealed that the Wounaans currently do use the **medialunas** in most cases. In our visits to Puerto Pizario, we found only one palm that had been cut down among ca. 22 palms that had been harvested using the **medialuna**. Afro-Colombians probably also use **medialunas** today to cut spear leaves. Informants from the Afro-Colombian community of Cabeceras claimed that they do use them, but we were not able to verify this.

Spear leaf harvest is mostly done by men since the use of the **medialuna** (or cutting down the palm) requires considerable physical strength. Appropriate palms to harvest are identified in the forest during hunting expeditions or while doing other daily activities, but sometimes the villagers set out exclusively to search for spear leaves. It is also common to cultivate a group of palms in home gardens in order to keep a supply of spear leaves. Leaves are usually cut when the moon is waning, as, according to the local belief, this gives them a longer duration. Harvestable palms are recognized based on their height and general appearance. The most important criterion is the width of the pinnae. Palms begin to be harvestable when their crown is leafy (ca. 9 leaves) and their pinnae are 30-40 mm wide. This condition is attained when the stem is at least 5-6 m tall. Appropriate leaves are those that are about to expand, measuring 3-4.4 m in length, and they can be recognized by their grayish green color, and their prominent size and thickness. Palms harvested in Puerto Pizario during our study were 5-11 m tall (X: 7.99; SD: 1.95; n: 21), with 9-10 leaves (X: 9.57; SD: 2.58; n: 21); ca. 16% were adults and the rest were subadults. Leaf production in harvestable palms was ca. 3 leaves/palm/year (X: 3.10; DS: 0.63; n: 54).

The **medialuna** is useful to harvest palms up 6-7 m tall. In order to reach taller palms, harvesters need to climb nearby trees and to use the tool from there. Sometimes rustic platforms are made for an easier access to the spear leaf without damaging the palm. According to our informants, a major problem with the **medialuna** is the great size and weight of the pole, which makes it difficult to carry the tool throughout the forest. No other tools are known for harvesting this spiny palm.

The Wounaan claim that palms growing in disturbed, illuminated sites, like forest plots or fallows, start producing harvestable leaves at a lower height, whereas forest palms can be harvested only when they are taller than 8-9 m. Our own data confirmed this perception. In our plots in Puerto Pizario, palms growing in forest plots or fallows were on average 7 m tall (X: 7.157; DS: 1.723; n: 14) and had ca. 8 leaves (X: 8,429; DS: 1,555; n: 14), whereas forest palms, on average, were 12 m tall (X: 11.857; DS: 2.795; n: 7) and had 10 leaves (X: 9.643; DS: 1.215; n: 7).

Once the spear leaf is harvested (only one per palm), the rachis spines are removed with a small machete, and the leaf is beaten with it in order to loosen the leaflets, which are then detached manually (Figure 2). Only the longer, central leaflets are used; basal and apical ones are discarded. On average, 150-200 leaflets per leaf are used; ca. 20-28 basal leaflets and ca. 25-27 apical leaflets are discarded. Appropriate leaflets measure 120-140 cm long and 3-4 cm wide. Leaflets narrower than 3 cm are considered unsuitable, as they do not provide enough fiber. Once the leaflets have been detached, they are tied into a bundle, and harvest proceeds. On average, it takes a harvester 10-20 minutes to harvest a palm, but it can be ca. 60 minutes if the time of searching for the palm is included. Up to ten leaves can be harvested per day under favorable conditions, but as few as 3-4 are harvested if the palms are too tall or too far from each other. The same palm is often harvested once every year.

Processing

Both fiber extraction and handicraft weaving are done by women and all ages participate. Fiber extraction begins with the removal of the midrib, leaving two narrow half leaf blades. The upper layer of each blade (epidermis plus mesophyll) is then removed, peeling it from the base to the apex (Figure 3). It is this upper layer that will be twisted into the string that is used for weaving. The remaining part is discarded or used as the foundation rod of the coiled basketry. Whereas the Panamanian Wounaan use for the discarded midribs for making brooms (Velásquez 2001),

Figure 2. Harvesting spear leaves of *Astrocaryum standleyanum* L.H. Bailey by Wounaan Indians along the lower San Juan river in Colombia.

Figure 3. Processing leaflets of *Astrocaryum standleyanum* L.H. Bailey by Wounaan Indians along the lower San Juan river in Colombia.

we have not seen that use in the communities along the lower San Juan river, where spear leaves of the palm *Welfia regia* Mast. are the preferred material for brooms.

The leaflet peelings are soaked overnight with soap or detergent, and are then rinsed and hung to dry in the sun. Each one is split longitudinally into two narrower pieces, either before drying or at the time of twisting.

The next step is dying, which is made with natural dyes obtained from plants cultivated in the forest or near dwellings. By the 1970s, when the Wounaan started to weave these type of baskets, they were made mostly in natural color or had a combination of orange and black (Bernal *et al*. n.d.). In recent times, the Wounaan have incorporated new colors. The plants used for dying include **bija** (*Bixa orellana* L.: Bixaceae), which renders a deep orange color; **puchicama** (*Fridericia chica* (Bonpl.) L.G. Lohmann: Bignoniaceae), which gives either a light orange color, or a black color if the fiber is buried in mud for 48 hours; and **cúrcuma** (*Curcuma longa* L.: Zingiberaceae), which gives a yellow color. Although other plants are used, the Wounaan prefer not to reveal their names or the processes involved; a total of nine colors are found in the current Wounaan basketry - natural, red, black, orange, yellow, brown, green, light purple, and a deep, wine-colored red obtained by mixing several dyes (Torres & Avendaño 2009). The Wounaan and Embera in Panama use eight species of plants as dyes, but also there the names of some were not disclosed (Velásquez, 2001). Dyeing is achieved by boiling the fiber with the dye for 15-60 minutes, depending on the pigment; the fiber is then rinsed with abundant water and hung to dry in the sun. No mordents are used, and thus colors fade over time. The whole process, including gathering the plant and processing the dye, takes up to one day.

Basketry production and marketing

All artifacts produced with *A. standleyanum* fiber are woven with the technique of single rod coiled basketry, consisting in sewing a thread around a foundation (the rod) of uniform diameter (Figures 4, 5). The stitch passes around the coil in progress, and is caught under the preceding coil (Figure 6). The first step in weaving a piece is to make the foundation rod, which consists of a core tightly wrapped with *A. standleyanum* fiber strips; the core is made out of the discarded laminas of *A. standleyanum* itself, or it can include unopened leaves of other palms, like **quitasol** (*Mauritiella macroclada* (Burret) Burret), **amargo** (*Welfia regia* Mast.), **jicra** (*Manicaria saccifera* Gaertn.), or from **iraca** (*Carludovica palmata* Ruiz & Pav.: Cyclanthaceae) (Torres & Avendaño 2009). The preferred material among these is *M. macroclada*, which makes it easier to build a foundation. *Mauritiella* spear leaves are harvested in the same way as those of *A. standleyanum*.

Rolls vary in diameter depending on the quality of the piece to be woven. Thin rolls (ca. 5 mm diameter) are used for high quality baskets whereas thicker rolls (8-10 mm in diameter) are for ordinary pieces. Weaving on a thin roll requires a larger amount of *A. standleyanum* thread and a longer weaving time. Making an appropriate roll requires expertise, and elder weavers often prepare the rolls for younger ones being trained; this is common between mothers and daughters.

Women weave sitting on the house floor. They hold the strips of fiber between their first and second toes, and then with a fingernail or with a needle they tear it into several thread-like strips. Then they twist the active strip, polish it, thread it through a needle, and proceed with the stitch. Usually all of these activities are carried out simultaneously; sometimes, however, the threads are twisted before starting the weaving.

Artifacts woven with *A. standleyanum* include mostly baskets and trays. Baskets range from 15-80 cm in height; trays are 12-35 cm in diameter. The latter can be made either entirely of *A. standleyanum* or they can include a carved wooden base. Depending on the size and the technique used, it can take a weaver one to several months to complete a piece, working ca. 4 hours/day. Decoration includes basic geometric figures and anthropomorphic or zoomorphic figures (Figures 4-6). According to Hernández (2003), the patterns are not always planned but are decided as the weaving progresses; only experienced weavers define the pattern before starting (Gallego 1995).

One leaflet of *A. standleyanum* produces two strips of fiber, and 2-5 threads can be obtained from each. Thus, one leaflet will produce 4-10 threads, with an average length of 130 cm. With an average of 175 leaflets per leaf, a total of ca. 1600 m of thread can be obtained from a single spear leaf.

The number of spear leaves required to produce various kinds of pieces varies from 1-6 (Table 1). These figures, however, are approximate, as women do not keep a re-

Table 1. Some *Astrocaryum standleyanum* L.H. Bailey products made by Wounaan Indians of the lower San Juan river in Pacific Colombia.

Product	Size (cm)	Weight (g)	Time consumption (hours)	Spear leaves (unit)	Sale price ($USD)
Vase	36x30	1750	350	6	400
Vase	27x19	875	180	2	45
Tray	30.7x19.8	525	100	1	40
Tray	58x28.3	1000	190	3	150

Figure 4. Making the foundation rod with leaves of *Astrocaryum standleyanum* L.H. Bailey by Wounaan Indians along the lower San Juan river in Colombia.

Figure 5. Unfinished vase showing the coil. Handicraft made with *Astrocaryum standleyanum* L.H. Bailey fibers.

Figure 6. Weaving a tray with leaves of *Astrocaryum standleyanum* L.H. Bailey by Wounaan Indians along the lower San Juan river in Colombia.

Figure 7. Vase with thick coil and loose weaving made with *Astrocaryum standleyanum* L.H. Bailey fibers.

Figure 8. Vase with thin coil and dense weaving made with *Astrocaryum standleyanum* L.H. Bailey fibers.

cord of the volume of raw material used. On average, a family uses 4-10 spear leaves per month, depending on the number of women in the household and on the season.

Pieces can have a loose (Figure 3) or a dense (Figure 7) weaving. The latter are more common, although their production requires a longer time and a larger amount of raw material. Prices vary accordingly, and also depending on the colors and designs. A way to test whether a piece is properly woven is to press on the bottom. If it remains firm, it is considered a good quality item; if it sinks, it is deemed as being of poor quality.

Our Wounaan informants told us that the amount of work invested in producing *A. standleyanum* basketry is not well compensated by the income they have from selling it. The best earnings are obtained when artisans take part

Figure 9. Big vase made with *Astrocaryum standleyanum* L.H. Bailey fibers.

Figure 10. Tray made with *Astrocaryum standleyanum* L.H. Bailey fibers.

in the Annual National Handicraft Fair, the country's largest handicraft fair, held every year in December in Bogotá. Most families work intensively during a great portion of the year in preparation for this fair, yet not all families can participate, as only the best works are accepted. The Wounaan claim that sales in this fair have decreased in the last few years, affecting their cash economy. Another way of marketing is through a middleman who travels through the region buying pieces or exchanging them for goods such as clothes, fabrics or shoes. He earns between 20-50% of the final sale price. These pieces are taken to local fairs or specialized shops in Cali, Medellín, Pereira, Manizales and other Colombian cities, or they are sold in Ecuador. Some Wounaan living in Bogotá sometimes act as middlemen and sell the pieces directly or through the internet (www.artesanum.com/artesanias-kherden-16327-1-0.html). Some products are sold directly to tourists by the Wounaan artisans themselves at tourist sites close to Buenaventura.

Commerce of raw material is scarce, and it takes place mostly locally from Afro-Colombians to Wounaans. In 2010 the price of a spear leaf at the lower San Juan river was ca. USD 5. We know of only one case of raw material being sold outside the lower San Juan river area, and that was to a Wounaan family living in Bogotá. They are said to buy ca. 100 spear leaves per year.

Astrocaryum standleyanum basketry is the main source of cash income for most Wounaan families along the lower San Juan. For some of them it is actually the only source of cash. Monthly revenue derived from this activity was USD 40-60 per family in 2010-2012, whereas minimum monthly wage in Colombia over the same period was USD 265-318.

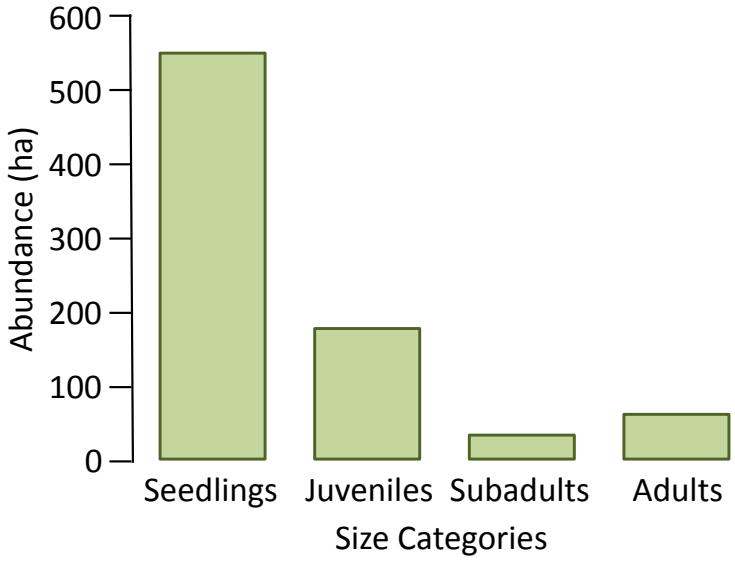

Figure 11. Average number of individuals/ha of seedlings, juveniles, sub-adults and adults of *Astrocaryum standleyanum* L.H. Bailey at Puerto Pizario, lower San Juan river, Colombia.

Management and conservation

Astrocaryum standleyanum population structure at Puerto Pizario in 2011 is shown in Figure 11. The observed population structure of *A. standleyanum* suggests that the population is regenerating well and that it is growing. However, this varies between ecosystems, and its growth is considerably higher in abandoned forest plots, as a result of management practices. When the Wounaan clear a forest area for planting crops, they spare all stemmed *A. standleyanum* individuals, and sometimes also large stemless juveniles. These plants produce harvestable leaves and reproduce at a lower height than comparable individuals in the forest. When a forest plot is abandoned, the palms start to reproduce in a short time, and contribute a large number of seedlings to the plot.

Another type of management involves transplanting seedlings to home gardens or the forest. This practice has resulted from the interest of the Wounaan themselves and from initiatives promoted by the government or by NGO's. The success of this practice is evidenced by occurrence of areas where many palms, as well as dye plants, are developing.

Discussion

The way that the Wounaan use *A. standleyanum* fiber is remarkably different from how Afrodescendants and mestizos farther south in the Pacific lowlands of Ecuador use the fibers of the same palm. In Ecuador the whole leaflets are used for weaving hats, mats, and furniture (Borgtoft Pedersen 1994, Fadiman 2008), in the same way as the leaflets of *Astrocaryum malybo* H. Karst. are used by peasants in northern Colombia (García *et al*. 2011). Hats produced in this way along the Tapaje river, in southwestern Colombia were recorded by Patiño (1977), but we have not found this kind of hat during our trips to that area in the last few years. Although fiber from the epidermis and mesophyll of *A. standleyanum* is rarely extracted in Ecuador it does occur, for instance for tying leaflet bundles during harvest (Fadiman 2008) or for weaving hammocks and fishing nets (Borgtoft Pedersen 1994).

Management of *A. standleyanum* by the Wounaan along the lower San Juan river differs in several respects from management described for the same species in Panama (Velásquez 2001) and Ecuador (Borgtoft Pedersen 1994, Fadiman 2008). The cur-

rent trend along the lower San Juan river is to harvest the spear leaves without cutting down the palms, as they did in the late 20th century. A similar non-destructive harvest existed among Afrodescendants and mestizos in the Ecuadorean provinces of Manabí and Esmeraldas (Borgtoft Pedersen 1994, Fadiman 2008), whereas in nearby areas the Chachi Indians inhabiting the Reserva Ecológica Mache-Chindul used to cut down the palms. Destructive harvest was also practiced among the Wounaan and Embera of Panama (Velásquez 2001). We do not know whether the harvesting practices in those regions have changed in the recent past, as abandonment of the malpractice of felling palms can be achieved in a short time as a result of appropriate campaigns, as it happened with the Wounaan along the lower San Juan river (Bernal *et al*. n.d.).

In spite of the change to more sustainable harvest practice of *A. standleyanum* by the Wounaan along the lower San Juan river, complete sustainability may not have been achieved. A shortage of **medialunas** in the Wounaan villages has been a common complaint, and it might have led to some palms being unnecessarily cut down. This problem can be easily solved through additional educational campaigns and by making **medialunas** widely available in the region. Considering that the most difficult step in the conservation campaign was already successful, this further refinement could be readily implemented.

Leaf production of *A. standleyanum* at our study site was 3 leaves/palm/year, a figure much lower than production reported by Usma (1996) in the same area (6 leaves/palm/year), but close to the number of 4 leaves/palm/year reported for the same species in Panama (De Steven *et al*. 1987). Discrepancy between our and Usma's figure may be caused by different observational techniques. On the other hand, a report of 8 leaves/palm/year in Ecuador (Borgtoft Pedersen 1994), based on information of local people, may rely on casual, non-systematic observations, and is not trustworthy. Thus, we will base our recommendations on our own data.

Based on our results for leaf production rate, we recommend harvesting every other leaf, i.e., 1-2 leaves/palm/year. At the lower San Juan river all observed palms had 9-10 leaves in the crown, including 1-3 stumps of harvested leaves. Considering the leaf production rate of 3 leaves per year, this means an age of 3-3.3 years for the whole crown. Thus, the figure of 1-3 cut leaves represents a harvest intensity of 0.3-1 leaves/palm/year, i.e., a figure lower than the one we recommend. This low pressure on individual palms reflects both the interest of the Wounaan in the conservation of *A. standleyanum*, and an adequate supply of the resource, at least under the current market demand. As a matter of fact, in all Wounaan villages our informants emphasized their change of mind towards this palm species. Only in some places accessible to both Wounaan and Afrodescendants did we observe palms with all their leaves harvested.

Although the proportion of harvestable palms in Puerto Pizario appears to be increasing, subadult numbers are still low. We found 34 subadults and 62 adults per ha, whereas in the Ecuadorean province of Manabí, Borgtoft Pedersen (1994) found 67 subadults and 67 adults per ha. The low number of subadults at Puerto Pizario probably reflects the destructive harvest that took place in the late 20th century. Balslev (unpublished data) found only 30 adults per ha in undisturbed forests at Bahía Málaga, ca. 25 km southwest of Puerto Pizario. In fact, it indicates that the proportion of palms is considerably higher in abandoned forest plots close to the villages.

The current management of *A. standleyanum* by the Wounaan suggests that the palm could easily be incorporated into agroforestry systems combined with cocoa (*Theobroma cacao* L.), **borojo** (*Borojoa patinoi* (Alibertia patinoi (Cuatrec.) Delprete & C.H. Perss.), soursop (*Annona muricata* L.), banana (*Musa acuminata* x *balbissiana* Colla) and taro (*Colocasia esculenta* (L.) Schott). As a matter of fact, the Wounaan themselves suggest that one should plant crop trees or shrubs near the palms, as that will make it easier to reach the spear leaf when the palm grows too tall to be harvested from the ground. Inclusion of *A. standleyanum* in agroforestry systems would guarantee a permanent supply of the fiber, whatever the demand may be in the future, as regeneration of this palm has been reported as high under agroforestry in Ecuador (Borgtoft Pedersen 1994). In fact, regeneration of *A. standleyanum* in Panama was higher in secondary growth than in mature forests (De Steven *et al*. 1987).

Apparently transplanting of seedlings of *A. standleyanum* by the Wounaan along the lower San Juan river has been successful. However, it is advisable to follow Borgtoft Pedersen's (1994) recommendation of transplanting the seedlings with a large amount of soil, to avoid the slow growth or early death observed in Ecuador, which this author attributes to a probable lack of mycorrhizae.

The use of *A. standleyanum* in agroforestry systems might be improved if its fruits were used as food. Their pulp has been reported as palatable and tasting like mango (Borgtoft Pedersen 1994), although others says it is unpalatable (Patiño 1977). In southwestern Colombia some people believe that there are two varieties of this species, one with edible fruits and another one with poisonous fruits (Galeano & Bernal 2010). This belief, however, has been interpreted by Cuadros (1977), as a possible allergic reaction of some people to some component in the fruit. Along the lower San Juan river the fruits are not used, although some Wounaan suggested that the fleshy mesocarp could possibly be used for food or to prepare juices. Further research is still required. In any case, at least the oleaginous seed might be used as an animal feed or as a source of oil. According to Patiño (1977), the seeds of *A. standleyanum* can produce ca. 20% oil and 5% protein.

Another use of the fruits is the production of rings out of the endocarp, as has been documented by Patiño (1977), Fadiman (2008), and Bernal & Galeano (2010). This use generates a minimal income to the Wounaan, not only because the rings are cheap and have a low demand, but also because the Wounaan sell the endocarps to middlemen with no processing, and the rings are produced in Cali and Bogotá. The price of a ring in a handicraft shop in Bogotá in 2010 was USD 1 (Valderrama 2011). With some simple training and the appropriate tools, ring production could be done by the Wounaan themselves, thus generating additional, although small, cash income from the palm. This use probably does not have a strong impact on the populations of *A. standleyanum*, as palm populations are usually scarcely sensitive to changes in fecundity (e.g., Bernal 1998, Olmsted & Alvarez-Buylla 1995).

Although *A. standleyanum* basketry is a major source of cash income for the Wounaan along the lower San Juan river, it is clear that the revenue is low compared to the amount of work involved in harvesting and processing the fiber, and in weaving the pieces (Valderrama 2011). We calculate that they earn less than USD 1 per hour invested. Although five ways of marketing the products have been recognized (this study, Torres 2006, Valderrama 2011), it is the attendance to the annual National Handicraft Fair in Bogotá that gives the artisans the highest revenue. According to Valderrama (2011) products sold at the fair fetch prices that are 40-67% higher than prices obtained by selling to middlemen in the villages. However, attendance to the fair is limited, and only a few communities take part during any one year. Fadiman (2008) considers that the best option for marketing *A. standleyanum* handicrafts in Ecuador is the direct sale to tourists at the production sites. Tourism in the Wounaan territory is currently minimal, however, and new channels should be explored whereby Wounaan basketry can reach other touristic sites along the Pacific coast.

Management of *A. standleyanum* along the lower San Juan river has changed dramatically in the last 15 years. Integration of traditional knowledge with non-destructive practices makes *A. standleyanum* basketry more sustainable, thus preserving this artisanal tradition and source of cash income. It is necessary, however, to strengthen good practices, to reinforce the introduction of the palm in agroforestry systems, and to promote fairer and more diverse marketing channels. Past experience shows that a sustained campaign can have positive results. If additional efforts are made to cover these points, *A. standleyanum* will continue to be a sound source of income to the Wounaan, and an icon of their culture.

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