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PALMS AS SOURCE OF NON-TIMBER FOREST PRODUCTS IN THE SOUTHERN BAHIA COAST, BRAZIL

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In this article we present the current information available about palms that occur in the southern coast of Bahia state, Brazil, and their potential uses as non-timber product suppliers (NTFPs) for sustainable forest management. Palms occurrence was obtained from Herbaria data of the Cocoa Research Center (CEPEC/CEPLAC) and Universidade Estadual de Santa Cruz (HUESC). Twenty-five species from seven genera have been identified. The genera *Attalea* and *Euterpe* are the most used palms for NTFPs. About 85% of native palms have potential uses for food products, 20% show potential for handcrafting, 20% are oil source and 4% are used for medicine products. Among the 25 native palm species occurring in Southern Bahia coast, only three are frequently used as source for NTFPs. Despite of the high diversity and their morphological variations, potential uses and adaptation capacity to different environments, the sampled palm species are still poorly studied, concerning their ecology, ethnobotany and management. The current challenge is to design studies and technologies for the adequate transformation of native palms into commercially, socially and ecologically viable NTFPs.

Key words: Agroforestry systems; Arecaceae; biodiversity; sustainable forest management.

Palmeiras como recursos florestais não-madeireiros na Região costeira do Sul da Bahia, Brasil. Neste artigo nós apresentamos informações atuais sobre as palmeiras da região costeira do sul do estado da Bahia e seus usos potenciais como fornecedores de produtos não madeireiros (NTFPs) para o manejo florestal sustentável. Os dados de ocorrência de palmeiras na área de estudo, foram obtidos nos herbários do Centro de Pesquisas do cacau (CEPEC/CEPLAC) e Universidade Estadual de Santa Cruz (UESC). Vinte e cinco espécies pertencentes a sete gêneros foram identificadas. Os gêneros *Attalea* e *Euterpe* são os mais usados como produtos não madeireiros. Cerca de 85% das palmeiras nativas tem potencial uso como produtos alimentícios, 20% tem potencial para artesanato, 20% são recursos para óleo e 4% para produtos medicinais. Das 25 espécies de palmeiras nativas da região costeira do sul da Bahia, apenas três são frequentemente utilizadas como recursos não madeireiros. Apesar da alta diversidade, de suas variações morfológicas, capacidade de adaptação a diferentes ambientes e diferentes usos potenciais, as espécies de palmeiras da região costeira do sul da Bahia ainda são pouco estudadas quanto a ecologia, etnobotânica e manejo. O desafio atual é delinear estudos e tecnologias para a transformação adequada das palmeiras nativas em produtos não madeireiros comercialmente, socialmente e ecologicamente viáveis.

Palavras-chave: Arecaceae; biodiversidade; manejo florestal sustentável; sistemas agroflorestais.

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Introduction

The Brazilian Atlantic Forest is among the top five world's hotspots in the world for biodiversity conservation (Myers et al., 2000). The Atlantic Forest portion located in the southern coast of Bahia state has a high level of endemism and species richness and represents the largest remaining fragment of the Atlantic Forest (Martini et al., 2007; Thomas and Barbosa, 2008). These areas are composed of sandbanks, mangroves, wet forests and liana forests, rich in tall trees, epiphytes and a floristic composition that changes according to the altitudinal and climatic gradients (Thomas, 2003; Thomas and Barbosa, 2008). A great proportion of the landscape is characterized by a mosaic of old growth and secondary forests interspersed with cocoa rustic agroforestry system cultivation (Schroth et al., 2011). The protection of the Atlantic Forest of the southern coast of Bahia state and the rational use of local flora as non-timber forest (NTFP) resources in agroforestry systems is an indubitable initiative to associate conservation with economic development.

Tropical forests are a potential source of important plants and other resources for economy, medicine, regional climate and people wellness. In this context, the rational exploration of NTFPs can become is an alternative for supporting biodiversity conservation and other environmental objectives and at the same time can help local communities by providing employments and incomes, offering opportunities for processing enterprises, contributing to household food security and nutrition and improving livelihoods. The sustainable use of NTFPs has been an effective strategy to harmonize the conflicts between productivity and conservation interests (Balzon et al., 2004). Thus, forests have been valued by the variety of products available for the market (Santos et al., 2003). Most forest products are used as raw material for industry or as semi-manufactured products, but parts of the plants may be traded as fresh products or as handcrafts (Santos et al., 2003; Rufino et al., 2008). In Brazil, the NTFPs are a promising market that conciliates economy and environmental conservation (Balzon et al., 2004; Almeida et al., 2009).

Palms constitute an important component of tropical forest communities and are the most useful group of plants in tropical American forests. Brazil has a huge variety of palm species and for this reason the country was known as "Pindorama" by the indigenous people, a word from the native "Tupi" language that means "Palms Land" (Bondar, 1964). Most palms are economically useful for human beings and produce valuable non-timber forest products, as fruits and oil for feeding, leaves for cottages covering, fibers for brushes, strings, brooms and clothing, and source material for hats, fans, mats, sieves, soap and waxes (Bondar, 1964; Noblick, 1991). The palms are included in the Arecaceae family, order Arecales. This family is one of the largest botanical families in the world and an important component of tropical forest communities. Arecaceae family presents a predominantly Pantropical distribution and includes about 200 genera and 2,000 species. The South America is one of the Arecaceae diversity centers, with five endemic genera (Pintaud et al., 2008). For instance, a study made by Steege et al. (2013) in the Amazon region, found three palm species [*Euterpe precatoria* Mart., *E. oleraceae* Mart. and *Attaleabutyracea* (Mutis*ex*. L. f) Wees Boer] within the 20 top-hyperdominant species. Palms are also key food sources for many frugivorous, such as monkeys, birds, fishes and insects (Noblick, 1991), not only because they constitute an abundant source, but also because their fruits are available in periods of scarcity (Galetti and Aleixo, 1998; Genini et al., 2009). In the south of Bahia, a landscape study showed that forest cover reduction negatively affects Arecaceae species richness (Oliveira, 2013; Benchimol et al 2017), indicating that, although palm species are common and widespread in Atlantic Forest, anthropogenic alterations such as defaunation and deforestation may lead population species to decline.

Palms have basic similarities with other tree species, such as the presence of roots, trunk, leaves, flowers and fruits. However, these same organs present characteristics that are particular to this family, for instance, trunk with the absence of secondary growth, leaves with a fan aspect, or stem with leaf scars, peduncular bract, inflorescence enclosed by spathe, presence of the heart of palm, among others (Lorenzi, 2010). There are multiple uses for palms as a source for NTFPs. Palm leaves are used for covering cottages and huts and for production of mats, strings, baskets, hats, brooms and several other craft products (Coomes,

2004; Rufino et al., 2008; Valente, 2009; Troian, 2009; Luz, 2011). Fruits, oils and the heart of palm can be used in human feeding and food industry (Troian, 2009). Palm fruits have important nutritional properties and are energy source, pro-vitamin A, fibers, lipids and carbohydrates (Corner, 1966; Luz, 2011). The oil extracted from palms is widely used in the cuisine, industry of biodiesel and paints. Several palm species have potential for landscaping and seedling production may represent an important economic source for small farmers and local people subsistence (Luz, 2011).

We accessed palms as an import source for NTFPs and for linking conservation to economic development of local communities in the southern coast of Bahia. The objectives of the study: a) to make a survey of the current knowledge of native and/or endemic palm species based on the data collected in the two largest herbaria of the region; and b) to discuss the potential uses of palm species as NTFPs for sustainable forest management and biodiversity conservation.

The southern coast of Bahia

Our survey was focused on the southern Bahia coast, from the municipalities of Valença (13º22'S and 39º4'W) to Canavieiras (15°39' and 38°57'W). This region is notable for being part of the Central Corridor of the Brazilian Atlantic Forest, which is a priority area for biodiversity conservation (Myers et al, 2000). The region is divided into two microregions: the microregion of "Valença", or "Baixo Sul da Bahia", and the microregion of "Ilhéus-Itabuna" or "Cocoa Region". The "Baixo Sul da Bahia" has a diversified economy based on the agriculture of perennial crops, such as cloves (*Syzygium aromaticum* (L.) Merr. & L.M. Perry), cocoa (*Theobroma cacao* L.), guarana (*Paullinia cupana*Mart.), rubber tree (*Hevea brasiliensis* Müell. Arg.), black pepper (*Piper nigrum*L.), coconut (*Cocos nucifera* L.), oil palm (*Elaeis guineensis* Jacq.), banana (*Musa* spp.), citrus (*Citrus* spp.) and coffee (*Coffea* spp.). In the Cocoa Region, besides the cocoa plantation and the more recent cattle farming, there are other permanent and temporary cultivations, such as banana, citrus, sugarcane (*Saccharum officinarum* L.), coconut and cassava (*Maniho tesculenta* Crantz) (Alcoforado, 2003). The cocoa plantation is the most important economic activity in the region. It was introduced in the south of Bahia in the middle of the XVIII century (Dean, 1996). Since the first crops, cocoa has been cultivated in a rustic agroforestry system named 'cabruca'. In this system, forest understory is thinned and cocoa is planted under the shade of some remaining native trees, thus leaving part of the original vegetation (Rice and Greenberg, 2003; Sambuichi and Haridasan, 2007; Schroth et al., 2011). This is one of the reasons for the existence of well-preserved areas of Atlantic Forest in the SCRBS. The cocoa farms were firstly established near the coast, along the areas of humid forests. Lately, the cocoa farms expanded to the interior of the country, and during this process, tracts of forest were left in areas where topography and soil fertility constrained cocoa cultivation.

Palm species distribution was obtained based on a survey of the data from two of the most representative herbaria of the Southern Bahia region, the "Centro de Pesquisas do Cacau" Herbarium (CEPEC/CEPLAC) and the "Universidade Estadual de Santa Cruz" Herbarium (HUESC), both located in Ilhéus, Bahia, Brazil. A survey of the Arecaceae records found in the Herbaria of CEPEC/CEPLAC and HUESC and the information of habitat and potential uses was performed. Types of habitat of palms occurrence were based on Environmental National Council (CONAMA), resolution 417/2009, and on descriptions of Thomas & Barbosa (2008). The potential uses were obtained from literature references, field research observations and by comparisons with other species that have similar morphological characteristics, those belonging to the same genus and already used by traditional people in other regions. The potential uses of indigenous palms from the SCRBS were classified as: food (plant parts consumed by humans), handcrafting (plant parts used as fiber source and other materials for handmade crafts), industry (plant parts used for manufacturing industrial products), medicinal (plant parts used for treatment/ prevention of diseases by traditional communities and medicine industry), oils source (plant parts used for oil extraction for food, fuel and derivate) and ornamental (whole plant or plant parts used for landscaping and home decoration).

In addition to the native species, it is worth mentioning the introduced species coconut palm (*Cocos nucifera* L.) and the "dendê" palm (*Elaeis guineensis* Jacq.). These species are commonly called as

"longtime adapted" palms. A "longtime adapted" palm is an introduced species that is not cultivated and had the seeds dispersed without antropogenic interference. According to Noblick (1991), these species have significant contribution to the Bahia flora, with widespread use in the local communities' culture, traditional cuisine and landscaping. Although the coconut palm is an introduced species, it is an important food source for more than 500,000 people in the country. The coconut palm is a species of great economic importance. Its products and by-products are raw material for industry and are widely commercialized *in natura* (Martins & Jesus Júnior, 2011). Similarly, the *E. guineensis* is also an introduced and well-adapted species in the coastal region of Bahia. This species represents the most cultivated palm in the world and Brazil is the second largest producer of palm oil (dendê oil). The dendê oil is widely used in the Northeastern Brazilian cuisine and, more recently, for biodiesel production (Watkins, 2011). Despite composing much of the landscape in southern Bahia, the species *E. guineensis*. was not included in the study because it is not native to the Atlantic Forest. Likewise, the coconut palm (*Cocos nucifera* L.) was not included, since there is no definite origin; although studies suggest that it originated in South America and radiated eastward through the Antarctic corridor to Africa, Madagascar and India (Gunn, 2004).

Palms of the southern coast of Bahia

Twenty-five species from seven genera are currently described for the southern Bahia coast (Table 1). About 85% of native palms have potential uses for food products. The medicinal uses of these palms are limited to 4%. About 77% of the sampled palm species show potential for handcrafting with their spathes, fibers from leaves and stem, and 20% of the species are oil source. Informal talks to rural people and personal communications showed that some uses are not documented in the literature. In addition, it was verified that among the 25 species of natural palms occurring in the southern coast of Bahia, only three species are frequently used by local people for NTFPs (*Attalea funifera* Mart., *Attalea humilis* Mart. and *Euterpe edulis* Mart.).

The exploitation of piassava palm is widespread throughout the whole Atlantic coast of the Bahia state. The flexible and waterproof fibers of this species are employed in both internal and external market for manufacturing of domestic and industrial brooms, charcoal, thermal insulation and mooring ropes for ships and source for traditional communities' handworks, such as bags and decoration crafts (Moreau, 1997; Guimarães and Silva, 2012). Piassava palm extractivism has a high ecological importance, since *A. funifera* is an endemic palm of Northeastern Brazil (Alagoas, Sergipe and Bahia states). According to the Flora do Brasil 2020 (2017) the species is only almost threatened because the extraction of its fibers does not destroy the plant. Therefore, the use of *A. funifera* for NTFPs associates the conservation of Atlantic Forest biome to the production of income for farmers (Moreau, 1997). Piassava palm also exhibit strong interaction with the local wildlife, working as support for bromeliads and orchids (Guimarães and Silva, 2012). In Brazil, the extraction of piassava fiber stands as the third non-timber forest product in value, after the extraction of açai fruit, of *Euterpe oleraceae* Mart., and the babassu almond, *Orbygnia speciosa* (Mart. *Ex* Spreng.) Barb. Rodr. Six municipalities in SCRBS (Ilhéus, Nilo Peçanha, Cairu, Ituberá, Canavieiras, Valença e Camamu) stand out as the main piassava fiber producers and are responsible for 93% of the Brazilian national product (IBGE, 2012).

In the Atlantic Forest, *E. edulis* is the most exploited species for heart-of-palms (Galetti and Fernandez, 1998) and due to the numerous illegal uses, this species is in the vulnerable extinction category (Flora do Brasil 2020, 2017) because it does not have the ability to resprout (Reis et al., 2000a). In the South and Southeastern Brazil there are several undergoing projects using *E. edulis* in agroforestry systems, as well as initiatives encouraging the commercial consumption of fruit pulp. These strategies enabled the establishment of the species in the Atlantic Forest thus contributing to the maintenance of local fauna (Reis and Kageyama, 2000). In the southern coast of Bahia efforts are also being made to develop strategies for planting and reintroduction of *E. edulis* in secondary forests and agroforestry systems based on studies on growth and survival of transplanted seedlings (Santos et al., 2012). In Santa Catarina state, southern Brazil, there is an incentive to the consumption of the fruit

Table 1 - List of characteristics of species of Arecaceae of natural occurrence in Southern Bahia, Brazil, based on data from UESC and CEPEC herbaria

Species	Commom Name	Uses	Useful plant parts	Habitat	Frequency of use
Allagoptera arenaria (Gomes) Kuntze	Caxandó, buriri	Food products, handcrafting, and orrnamental	Fruits and leaves	Open restinga	Medium
Allagoptera caudescens (Mart.) Kuntze	Buri, palmito-amargoso	Food products, handcrafting, and orrnamental	Fruits, heart of palm, leaves and spathes	Tropical wet forests	Medium
Attalea burretiana Bondar	Andaiá, catolé	Food products, handcrafting and oil	Fruits, leaves and seeds	Semidecidous seasonal forest and tropical wet forests	Medium
Attalea funifera Mart. ex Spreng. *	Piaçava-da-bahia	Food products, handcrafting and industry	Fruits and leaves	Open restinga and tropical wet forests.	High
Attalea humilis Mart.	Catolé, anajá-mirim	Food products, handcrafting, industry and oil	Fruits, leaves and seeds	Open restinga	High
Attalea voeksii Noblick ex Glassman	Pindoba-gigante	Food products and handcrafting	Fruits and leaves	Open restinga	Low
Bactris acanthocarpa Mart	Marajá, brejaubinha	Food products and ornamental[1]	Fruits and leaves	Tropical wet forests	Low
Bactris bahiensis Noblick ex A.J. Hend	Ouricana	Food products and ornamental[1]	Fruits	Tropical wet forests	Low
Bactris ferruginea Burret*	Mané-véio, tucum	Food products and handcrafting	Fruits and leaves	Open restinga and tropical wet forests	Medium
Bactris glassmanii Med.-Costa & Noblick ex A. J. Hend	Marajá	Food products[1], handcrafting[1] and ornamental	Fruits, leaves and spathes	Open restinga and tropical wet forests	Low
Bactris hirta Mart.	Marajazinho	Food products[1], handcrafting[1] and ornamental	Fruits and leaves	Tropical wet forests	Low
Bactris horridispatha Noblick ex A. J. Hend ***	Tucum-amarelo	Food products[1], handcrafting[1] and ornamental	Fruits, leaves and spathes	Tropical wet forests	Low
Bactris pickelii Burret	Tucum-mirim	Food products[1], handcrafting[1] and ornamental	Fruits, leaves and spathes	Tropical wet forests	Low
Bactris setosa Mart.	Tucum, uva-da-terra	Food products[1], handcrafting[1]	Fruits and leaves	Tropical wet forests	Medium
Bactris vulgaris Barb. Rodr.	Airi-mirim, tucum	Food products[1], handcrafting[1] and ornamental	Fruits and leaves	Tropical wet forests	Low
Desmoncus orthocanthos Mart.	Atitara, jacitara	Handcrafting and ornamental	Leaves	Tropical wet forests	Medium
Desmoncus polyacanthos Mart.	Atitara, titara	Handcrafting, medicinal andoiltree	Leaves and seeds	Tropical wet forests	Medium
Euterpe edulis Mart.	Juçara, palmito-juçara	Food products, handcrafting, industry and ornamental	Fruits, heart of palm, leaves, seeds and spathes	Tropical wet forests	High
Geonoma bondariana Lorenzi	Ouricana-de-baixio	Food products[1], handcrafting[1] and ornamental	Fruits and leaves	Tropical wet forests	Low

Continuation Table 1.

Geonoma conduruensis Lorenzi	Guaricanga-do-seco	Food products[1], handcrafting[1] and ornamental	Fruits, leaves and seeds	Tropical wet forests	Low
Geonoma pauciflora Mart.	Ouricana-mirim	Food products[1], handcrafting[1] and ornamental	Fruits, leaves and seeds	Tropical wet forests	Low
Geonoma pohliana Mart.	Araurí, ouricana-preta	Food products[1], handcrafting[1] and ornamental	Fruits, leaves and seeds	Tropical wet forests	Low
Geonoma rubescens H Wendl. Ex Drude	Ouricana	Food products[1], handcrafting[1] and ornamental	Fruits, leaves and seeds	Tropical wet forests	Low
Syagrus botryophora (Mart.) Mart.	Pati, patioba	Food products, oil and ornamental	Fruits, leaves and seeds and spathes	Tropical wet forests	Medium
Syagrus coronata (Mart.) Mart.	Licuri	Food products, handcrafting, industryand oil	Fruits, leaves, heart of palm, seeds and spathes	Open restinga and tropical wet forests and semidecidous seasonal forest	Low
Syagrus schizophylla (Mart.) Glassman*	Licuriroba	Food products, handcrafting[1] and ornamental	Fruits and spathes	Open restinga and restinga forest	Medium

* Almost threatened (Flora do Brasil 2020, 2017). ** Vulnerable (Flora do Brasil 2020, 2017) .*** Endemic of Bahia (Flora do Brasil 2020, 2017). [1] Indication of potential use, since there is a lack of studies on palm uses in the region.

from *E. edulis*. Studies indicate that the *E. edulis* fruit is a source of essential fatty acid linoleic acid (Omega 6), which is more nutritious than the açai fruit, from *E. olarecacea* (Schirmann, 2009). Food markets are avid for new-fashionable products as açaí, which has left Amazonian rural areas to reach urban centers throughout Brazil (Brondízio et al., 2002), with great perspectives for conquering world markets as Europe (Sabbe et al., 2009) and the USA as healthy functional food (Menezes et al., 2011). The growing interest of international markets towards health, novelty and exotic flavors (Pacheco-Palencia et al., 2008) indicates the potential of underexplored palm-berry food products.

The Arecaceae family is the third world most important group of plants for human use in the tropics, right after the Poaceae and Fabaceae families. However, despite its importance, there are few studies on the Arecaceae family for the Atlantic Forest. Most of the references for this family in Brazil are restricted to the Amazon region that is located mostly in Northern Brazilian territory and in other nine countries. Nonetheless, in Brazil, there was a significant increase in the number of publications of Arecaceae family during the past years. This increase in the number of studies about this family has led not only to an increase in the number of species registered, but also in the description of a variety of morphotypes within preexisted species. For instance, the species *Geonoma pohliana* Mart. is now divided into 11 sub-species that occur in Brazil, Venezuela and Colombia (Henderson, 2011). In Brazil, 40 genera and 300 species have been found over many types of tropical ecosystems. References about Arecaceae family include studies on etnobotany, ecology, taxonomy, phytossociology, physiology and economy. Among the native palms of the southern coast of Bahia, *Euterpe edulis* is the most cited in studies about ecology, physiology and seedling production (Galetti and Aleixo, 1998; Reis et al., 2000a; Reis et al., 2000b; Reis and Kageyama, 2000; Marcos and Matos, 2003; Silva et al., 2009; Troian, 2009; Favreto et al., 2010; Santos et al., 2012; Galetti et al., 2013; Lavinsky et al., 2014; Melito et al., 2014 and others), followed by *Attalea funifera* (Moreau, 1997; Vinha and Mattos-Silva, 1998; Aquino et al., 2001; Voeks, 2002; D'Almeida et al., 2006; Nascimento, 2009; Guimarães and Mattos-Silva, 2012; Pamponét et al., 2013).

A comparison of the data collected in the two herbaria with other different studies show that many other indigenous palm species have potential uses. For example, the pati palm (S*yagrus botryophora* (Mart.) Mart.) may have similar uses in comparison to other species of the same genus, such as licuri (S*yagrus coronata* (Mart.) Mart.) and licurioba (*Syagrus*

schizophylla (Mart.) Glassman) from the semi-arid region of northern Bahia State, that have edible fruits, oil rich seeds and useful fibers. In south of Bahia the Pataxó Indians use leaves of *S. botryophora* as an artefact for baking fish in their traditional cuisine (Amon and Menasche, 2008). In addition, the species *S.coronata* and *S.schizophylla* are known by the local people of the semi-arid region as the "tree of life", because they have edible and healthy fruits rich in lipids, and are source of oil and wax for handcrafting (Bondar, 1938) (Figure 1). The species *Bactris horridispatha* Noblick ex A.J. Hend and *Bactris glassmanii* Med.-Costa &Noblick ex AJ Hendmay also have similar uses of the species *Bactris soeiroana* Noblick, which is used for feeding, craft working, landscaping and honey production (Queiroz, 2007). Also, *Bactris ferruginea* Burretmay have potential for production of heart-palm, honey and oil as its close related to pupunha (*Bactris gasipaes* Kunth.) which is cultivated for heart-of-palm production (Marques and Coelho, 2003). Species belonging to the genus *Genoma* found in the southern coast of Bahia may also have similar potential uses for heart-of-palm production and landscaping like their congeneric species *Geonoma edulis* H. Wendl. in Costa Rica, and *Geonoma schottiana* Mart. and *Geonoma gamiova* Barb. Rodr.in the South and Southeastern Brazil (Aguiar et al., 1993; Sylvester and Avalos, 2009; Valente, 2009).

The most underexplored aspect of native palms is their use for landscaping. In general, all palms can be potentially used for indoor and outdoor landscaping, (Lima, 1993). A data collection made in ten important landscaping companies that sell palms in Brazil showed that 105 species are widely found in market, but only 18 of these species are indigenous of Brazil and two species, *S.botrhyofora* and *E. edulis,* are native of Southern Bahia. Most palm species used for landscaping in Brazil are from other countries, including Madagascar, Mexico, Vietnam, India, Mauritius Islands

Figure 1. Some palm trees of the southern coast of Bahia state, Brazil: (a) *Allagoptera caudenses*, (b) *Geonoma elegans*, (c) *Bactris glasmanii*, (d) *Desmoncus orthacanthos*, (e) *Bactris horridispatha*, (f) *Bactris pickelli*, (g) *Geonoma conduruensis*, (h) *Syagrus bontryophora*.

and the United States of America. The use of native palms in urban landscaping should be encouraged, serving as a source of food for birds and wildlife (Pereira et al., 2005). Moreover, this use of palms is highly lucrative. The greatest obstacle for the use of indigenous palms is the lack of study and knowledge about their ecology and cultivation methods.

The exploitation of non-timber forest products, if well planned, can be a link between the sustainable use of natural resources and the improvement of rural livelihoods. However, to ensure the sustainability of a particular plant species it is necessary to know the species biology, as distribution and abundance, habitat preferences, rate of productivity, reproduction and regeneration behaviors (Peres, 1994; Troian, 2009). It is hence worth emphasizing the importance of further studies regarding the biology, physiology and the domestication of native palm species. Although uses have been relatively well documented, the ecology and management of palms deserves more research and it is of great relevance for guaranteeing the long-term availability of these resources (Bernal et al., 2011). Unfortunately, the unsustainable management of palms appears to be more widespread than sustainable one. Recommendation for sustainable management by promoting the use of basic techniques of climbing, appropriate tools, selective harvesting based on age, size or sex of individuals, and introduction of palms in agroforestry systems and secondary forests, must be encouraged.

Although studies on taxonomy and ecology of Arecaceae have advanced in the last decades, information about floristic composition of the family is still scarce. Unfortunately, many individuals are excluded in phytosociological studies by the criterion of minimum diameter at breast height (Rocha and Silva, 2005) and most part of the studies about the potential uses of palms in the Atlantic Forest are limited to the Southern and Southeastern Brazil (Laps, 1996; Reis and Kageyama, 2000; Valente, 2009). Although local communities intensively use some palms, there is still a lack of knowledge about resources availability, productivity, ecological sustainability and market values for palm species. Moreover, the lack of organization of communities into associations and cooperatives hinders even more the information that would make possible the management of future financial investments on the innovation of products and in methodologies that can enable the sustainable management of palms (Santos et al., 2003). Finally, the lack of ethnobotanical and ecological studies about palms is another key factor that hinders the management and the sustainable exploration of palm species (Peres, 1994; Lorenzi and Souza, 1996; Troian, 2009; Luz, 2011).

Final considerations

The role of palms in tropical ecosystems is well recognized, but many species are threatened due to habitat fragmentation and ecological processes disruption like seed dispersal, herbivory, and seedling recruitment (Scariot, 1999). Palm species are important to traditional people subsistence and to world economical market (Bondar, 1964; Noblick, 1991; Clement et al., 2005). Therefore, among the strategies for biological conservation of the Southern Bahia Atlantic Forest, the use of species of Arecaceae family can be taken as an alternative that can guarantee the integration between species conservation and sustainable use of the natural resources.

The species of Arecaceae family represent an untapped potential source for the market of NTFPs, such as for food industry, for craftworks, landscaping and as source of oil and medicinal products. Among the 25 species of natural palms occurring in southern Bahia coast, only three are frequently used as source for NTFPs. Local communities have been using many species for a long time and some palms have been highlighted due to their high productivity, such as *Attalea funifera* and the "longtime adapted" species *Elaeis guineensis* and *Cocos nucifera*. However, there is no debate about the lack of information regarding palm species ecology, ethnobothany, plant productivity and products amelioration, for the native palm species from the southern Bahia coast. The current challenge is to promote studies for the correct transformation of palms into commercially, socially and ecologically viable products and to transfer these technologies to local communities.

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