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# Traditional populations in environmentally protected areas: an ethnobotanical study in the Soure Marine Extractive Reserve of Brazil

[Poblaciones tradicionales en unidades de conservación: etnobotánica en la Reserva Extractiva Marinha de Soure-Pará]

**Tainá Teixeira Rocha, Ana Cláudia Caldeira Tavares-Martins & Flávia Cristina Araújo Lucas**

***Universidade do Estado do Pará, Centro de Ciências Naturais e Tecnologia, Tv. Enéas Pinheiro, 2626, Marco, Belém, Pará, Brasil***
***Contactos | Contacts:*** **Tainá Teixeira ROCHA** - ***E-mail address:*** **tainarocha@yahoo.com.br**

**Abstract**: In the Amazon, there are significant numbers of indigenous and non-indigenous populations who depend on natural resources for their subsistence. The objective of this study was to conduct an ethnobotanical inventory in three communities (Comunidade do Caju-Úna; Povoado do Céu; and Vila do Pesqueiro) within the Soure Marine Extractive Reserve, located in the Archipelago of Marajó, in the state of Pará, Brazil. Data were collected through semi-structured interviews and participant observation. We performed the sampling using non-probabilistic methods and feature selection. In a quantitative analysis, we evaluated the following indices: total species diversity; informant diversity of a species; use value of a species; consensus use value of a species; and use equitability value of a species. Of the 215 ethnobotanical species listed for the Soure Marine Extractive Reserve, 79 were cited as useful by respondents. We identified nine use categories, of which medicinal use was the most often cited. The indices calculated showed that the level of species diversity is high in the Soure Marine Extractive Reserve. Many of the species in the area are of great utility and cultural value to the local population.

**Keywords:** Traditional knowledge, Archipelago of Marajó, ethnobotany

**Resumen:** La Amazonía alberga un diverso conjunto de grupos étnicos y culturales de pueblos indígenas y no indígenas, que dependen de los recursos naturales para su subsistencia. El objetivo de este estudio fue inventariar el conocimiento etnobotánico de tres comunidades en la Reserva Extractiva Marinha de Soure, situada en el archipiélago de Marajó-Pará. Se realizaron entrevistas semiestructuradas y observación participativa en las comunidades de Caju-Una, Poblado de Céu y Villa do Pesqueiro. El muestreo fue no probabilístico por selección racional. En el análisis cuantitativo se utilizaron los índices de diversidad total de especies (SDtot) y el del informante (IDs), el valor de diversidad de uso (UDs) y el de consenso de uso (UCs). Se listaron 215 etnoespecies, de las cuales 79 fueron citadas por los entrevistados de las tres comunidades. Se registraron nueve categorías, siendo la medicinal la más citada. Los valores encontrados para los índices calculados mostraron la diversidad de especies encontradas en la RESEX, además del gran valor utilitario y cultural de las mismas para la población local.

**Palabras clave**: Conocimiento tradicional. Archipielago de Marajó. Etnobotánica

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## INTRODUCTION

In the Amazon, there are significant numbers of indigenous and non-indigenous populations who depend on natural resources for their subsistence, including rubber tappers, nut gatherers, babassu palm nut crackers, and riverbank dwellers, and there is considerable cultural diversity (Diegues & Arruda, 2001; Brasil, 2002). The profile of these traditional communities or populations has risen in parallel with increasing awareness of environmental problems, in the context of the creation of environmentally protected areas, as described by Filho *et al.* (2009). These populations are repositories of a rich store of ethnoecological knowledge about the areas in which they reside (Moreira, 2007; Vianna, 2008). Therefore, they have become leaders in protecting biological diversity against destruction by external forces (Primack & Rodrigues, 2011).

In an effort to protect regions inhabited by traditional populations, specific areas designated extractive reserves (RESEX) were established as environmentally protected areas in 1990 (Drummond *et al.*, 2010). This became a *de facto* means of preserving the lifestyle and culture of such populations (Brasil, 2000; Verissimo *et al.*, 2011). Along the coast of the (Amazonian) state of Pará, Brazil, there are 21 RESEX, 9 of which are marine reserves (RESEX-Mar) (Moreira & Silva, 2012; ICMBio, personal communication). One of those, the Soure RESEX-Mar, located in the Archipelago of Marajó, was created with the objective of protecting the fauna and flora, thus ensuring the livelihood of the extractivists that inhabit the reserve (Ferreira, 2002; Oliveira, 2012), as well as protecting the rights of the local populations to maintain or regain control of the territory (Carneiro da Cunha & Almeida, 2000).

In the Soure RESEX-Mar, there have been studies focusing on the biodiversity of mangroves (Gardunho, 2009); on the generation of income, as targeted by government policies and programs, as well as social programs (Santos Júnior, 2006); on policies related to education and development (Ferreira, 2002); and on socioenvironmental problems and conflicts (Oliveira, 2012). To our knowledge, there have been no studies of the relationships between human populations and the flora in the Soure RESEX-Mar.

Ethnobotanists study the direct interactions between populations and the plants that occur in their sphere of influence, attempting to determine whether specific perceptions, values, and customs correlate with the ways in which natural resources are used (Albuquerque *et al.*, 2010). Ethnobotanical studies are aimed not only at safeguarding the lifestyles and customs of traditional populations but also at recognizing the potential uses of plant species (Lameira & Pinto, 2008; Pinto Sobrinho *et al.*, 2011). Such studies also promote the conservation of biodiversity in environmentally protected areas set aside for sustainable use (Queiroz, 2005).

The objective of the present study was to conduct an ethnobotanical inventory in communities within the Soure RESEX-Mar. We describe the local ethnoecological knowledge and the ways in which plant resources are used by the residents of those communities.

## MATERIALS AND METHODS

### *Study area*

The study was conducted in the Soure RESEX-Mar, which encompasses the Soure Mangrove and Rio Saco Mangrove, occupying a total area of 27,463.58 ha (Brasil, 2001). In addition to the mangroves, the ecosystems within the study area include coastal woodlands, floodplain forests, grasslands, and upland forests, as well as formations known locally as tesos, defined as vegetation growing at an elevation slightly higher than the water line during flood season (Brasil, 2001; Brasil, 2008; Rodrigues & Szlafsztein, 2011; Lisboa, 2012). Within the Soure RESEX-Mar (Fig. 1), there are three communities: Comunidade do Caju-Úna (CCU); Povoado do Céu (PC); and Vila do Pesqueiro (VP).

### *The lifestyle of the RESEX populations*

The RESEX-Mar Soure has a native population of 249 inhabitants: 74 in CCU; 70 in PC; and 105 in VP. The houses are made of wood, most having been constructed via government projects organized in partnership with the Brazilian *Instituto Chico Mendes de Conservação da Biodiversidade* (ICMBio, Chico Mendes Institute for Biodiversity Conservation).

The inhabitants of CCU and PC use community well water for domestic activities, whereas their drinking water, which is also used in cooking, comes in barrels, distributed twice a week, from the city of Soure. Because VP is closer to Soure, the water in that community is piped directly into the homes.

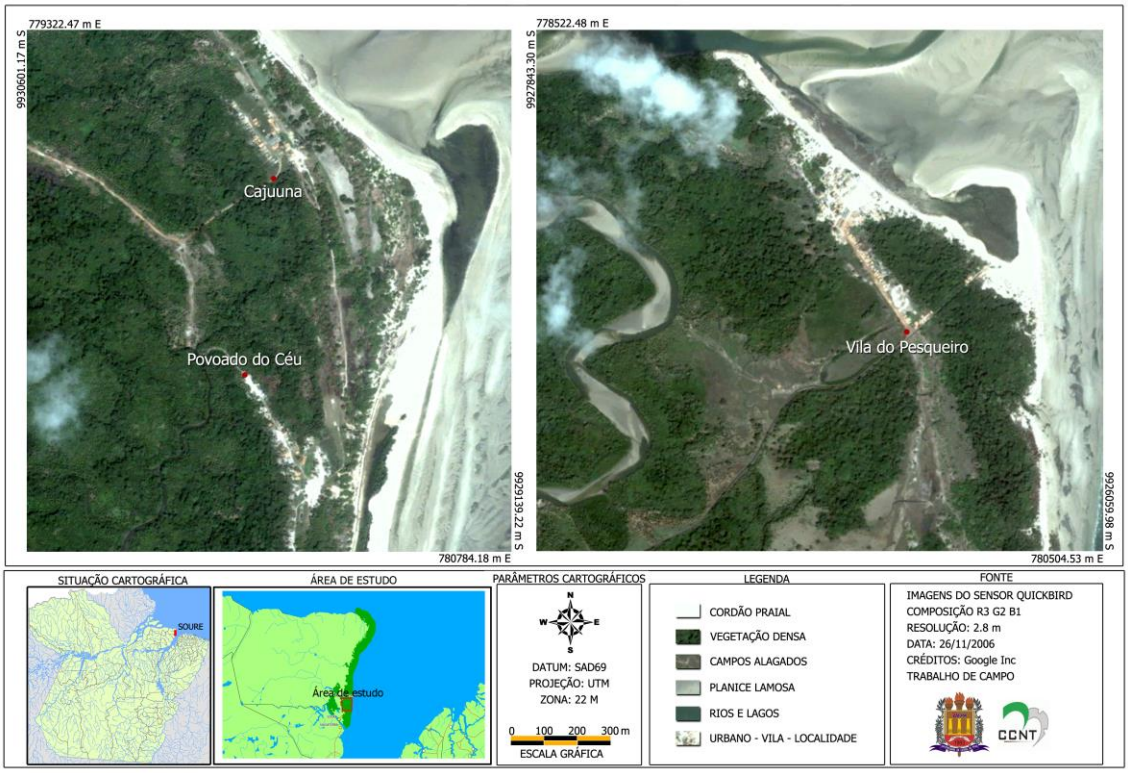
In each of the three communities, there is a basic health clinic, with limited infrastructure.

Community health agents, doctors, and nurses - alone or in teams - conduct periodic visits to treat simple ailments, such as colds, mild intestinal disorders (including diarrhea), headaches, and inflammation. Individuals presenting with clinical profiles that are more severe are treated in Soure or are transported to the state capital of Belém.

Of the 91 interviewees, the majority are registered as extractivist fishers, the remainder being public officials or retired individuals. One of the interviewees (a resident of PC) was registered as a coconut purveyor (one whose livelihood depends on the gathering and sale of coconuts). Approximately 10% of the interviewees stated that they were aware of the environmental problems caused by the unnecessary exploitation of resources in the RESEX. One PC resident (PCM, 31 years of age) said, "If you remove what is in front of the community (the vegetation), the sea will come in", thus expressing a common concern of the local residents. The residents receive so-called "green grants", which are subsidies provided by the government to promote the conservation of ecosystems through the maintenance and sustainable use of natural resources (Brasil 2013).

In addition to selling fresh fish, crabs, shrimp, and shipworms, the residents of the Soure RESEX-Mar supplement their income by selling bottled medicinal preparations containing oil *bicho tucumã* and oil *andiroba*. The fruits *muruci* (*Byrsonima crassifolia*) and *coco* (*Cocos nucifera*) are also sold in all three communities.

**Figura 1**
**Image map of the location of the communities studied in the Soure Marine Extractive Reserve, state of Pará**




***Data collection***

Data were collected between October 2012 and April 2013. During that period, we made five field excursions in order to apply questionnaires and collect botanical material. Botanical specimens were collected in accordance with the methods described by Fidalgo & Bononi (1984) and were identified at the João Murça Pires Herbarium of the Museu Paraense Emílio Goeldi (code, MG), in the city of Belém (also in the state of Pará). The scientific names of species were checked against the List of Species in the Flora of Brazil (Forzza *et al.*, 2017) and against the database of the Missouri Botanical Garden (Tropicos, 2017).

We interviewed 91 residents of RESEX-Mar Soure, distributed as follows: 38 in CCU, 26 in PC, and 27 in VP. All interviewees (community council members, other community leaders, and citizen-residents) gave written informed consent. In the present study, 80% of the interviewees were female and 13% were male (7% of the interviews involved couples consisting of one interviewee of each gender), which underscores the difference between genders in relation to ethnobotanical knowledge.

In our sampling, we used non-probabilistic methods and feature selection, including only those individuals who described themselves as plant users (Albuquerque *et al.*, 2010). In each community, the interviewees were often chosen with the help of a primary respondent. At times, we also employed "snowball" sampling, in which each interviewee recommends another resident to be interviewed next (Bailey, 1994), and we established alternative protocols to follow when that method failed (Gandolfo & Hanazaki, 2011).

We conducted semi-structured interviews (Albuquerque *et al.*, 2010), designed to collect socioeconomic data, to gather information about the plants utilized, and to determine the origin of interviewee knowledge about those plants (Negrelle & Fornazzari, 2007). In order to gain a better understanding of daily life in the communities under study, we used participant observation (Albuquerque *et al.*, 2010), which allowed us to obtain detailed descriptions of the popular uses of the plants, based on the experience and participation of the researcher (Camejo Rodrigues, 2007). In some cases (depending on the availability of the respondents), interviewees provided guided tours in order to match the popular names given in the interviews with the plants to which they refer (Albuquerque *et al.*, 2010).

***Quantitative analysis***

To analyze and interpret the data collected in our fieldwork, we calculated the following indices, as described by Byg & Balslev (2001) and Silva *et al.* (2010): total species diversity ($SD_{tot}$); informant diversity value (IDs); use diversity value (UDs); use consensus value (UCs); and use equitability value (UEs). Detailed descriptions of those indices are shown in Table 1.

**Table 1**
**Formulas for the indices employed.**

| Index | Formula | Description | Reference values |
|---|---|---|---|
| $SD_{tot}$ | $SD_{tot} = 1/\sum P_s^2$ | Indicates how many species are used and how they contribute to the total use | From 0 to n |
| $ID_s$ | $ID_s = 1/\sum P_i^2$ | Indicates how many informants use a species and how that use is distributed among them | From 0 up to the number of informants who use the species |
| $UD_s$ | $UD_s = (\sum U)/n$ | Indicates the value of the use of one species by one informant | From 0 to 1 |
| $UC_s$ | $UC_s = 2n_s/n-1$ | Indicates the level of agreement among the informants as to whether a given species is useful or not | From −1 to +1 |
| $UE_s$ | $UE_s = UD_s/UD_s max$ | Indicates how different uses contribute to the total use of a species, regardless of the number of use categories | From 0 to 1 |

**$SD_{tot}$ – total species diversity; $P_s$ – total contribution of a species *s* to the total use of all species evaluated; $ID_s$ – informant diversity of a species; $P_i$ – contribution of an informant *i* to the total body of knowledge of a species *s*; $UD_s$ – use value; *U* – number of uses mentioned by an informant; *n* –total number of informants; $UC_s$ – consensus use value of a species; $n_s$ – number of informants who use a species *s*; $UE_s$ – use equitability value of a species; $UD_s$ – use diversity of a species; $UD_s max$ – maximum possible use diversity of a species.**

## RESULTS AND DISCUSSION

### *Ethnobotanical knowledge and the use of natural resources*

Of the 215 ethnobotanical species listed for the Soure RESEX-Mar, 79 were considered useful in the communities evaluated. The CCU residents cited 42 species as being useful, compared with 26 species each for the residents of PC and VP. Of the 215 ethnobotanical species listed, we collected and identified 115 (Tab. 2), belonging to 49 families, the most common of which were Fabaceae, with 11 species, and Lamiaceae, with 9. The number of useful plant species collected and identified in the present study is similar to those also recorded for the state of Pará by other authors, such as Coelho-Ferreira & Jardim (2005), who identified 54 such species in a community on the island of Algodoal-Maiandeua, as well as Carneiro *et al.* (2010), who identified 23 in the community of Vila dos Pescadores, within the Caeté-Taperaçu RESEX-Mar. Cussy-Poma *et al*. (2017) in inventory on medicinal plants used in Bolivia found the families Asteraceae (14 species), Lamiaceae (four species) and Brassicaceae (four species) with the most used. While Torres et al. (2016) in an ethnobotanical survey in the Montuoso Forest Reserve, found Fabaceae (nine species) and Verbenaceae (four species) as the most abundant families. From the cited papers, we can observe that as in the RESEX-Mar Soure, Fabaceae and Lamiaceae also appeared with families with the largest number of species.

**Table 2**
**Species cited by informants, by use category and by number of citations per species, in the communities within the Soure Marine Extractive Reserve, in the state of Pará, Brazil**

| | | | Use categories | | | n of citations | | | Accession no. |
|---|---|---|---|---|---|---|---|---|---|
| Local name | Family | Species | **CCU** | **PC** | **VP** | **CCU** | **PC** | **VP** | |
| Alecrim da angola | Lamiaceae | Vitex agnus-castus L. | Me Sp | Me Sp | - | 8 | 4 | 0 | 173 |
| Acerola | Malpighiaceae | Malpighia punicifolia L. | Nu | Nu | Nu C | 4 | 2 | 6 | 279 |
| Ajiru, ajiru branco, ajiru preto, ajiru vermelho | Chrysobalanaceae | Chrysobalanus icaco L. | Nu Me | Nu | Me | 12 | 3 | 3 | 121 |
| Algodão | Malvaceae | Gossypium barbadense L. | - | - | Me | 0 | 0 | 2 | 318 |
| Ameixa | Myrtaceae | Syzygium cumini (L.) Skeels | Nu Me | | | 8 | | | 280 |
| Amor crescido | Portulacaceae | Portulaca pilosa L. | Me | Me | Me Sp | 5 | 2 | 15 | 119 |
| Ampicilina, miracelina | Amaranthaceae | Alternanthera brasiliana (L.) Kuntze | - | Me | - | 0 | 8 | 0 | 205 |
| Anador | Vitaceae | Cissus sp. | Me | Me | Me Sp | 6 | 4 | 10 | 39 |
| Apuí | Moraceae | Ficus catappifolia Kunth & Bouché | Me | - | - | 2 | 0 | 0 | 100 |
| Anun | Lamiaceae | Aegiphila sp. | - | - | Me | 0 | 0 | 1 | 305 |
| Araticum (jaca) | Annonaceae | Annona glabra L. | Nu Ar | Nu Me Ar | Nu Me Ar | 4 | 6 | 7 | 86 |
| Arruda | Rutaceae | Ruta graveolens L. | Me Sp | Me Sp | Me Sp | 27 | 10 | 26 | 43 |
| Babosa | Xanthorrhoeaceae | Aloe vera (L.) Burm. f. | Me | Me | Me | 11 | 10 | 20 | 38 |
| Bacuri | Clusiaceae | Platonia insignis Mart. | - | Nu | - | 0 | 4 | 0 | 343 |
| Bandeide | Fabaceae | Entada polystachya (L.) DC. | - | - | Ar | 0 | 0 | 5 | 255 |
| Barbatimão | Celastraceae | Maytenus obtusifolia Mart. | Me | Me Co | Me | 29 | 10 | 20 | 237 |
| Boldo, boldo sacaca | Asteraceae | Gymnanthemum amygdalinum (Delile) Sch.Bip. ex Walp. | Me | Me | Me | 12 | 13 | 2 | 33 |
| Breu branco | Burseraceae | Protium heptaphyllum (Aubl.) Marchand | Sp | Ir | Me Ir | 1 | 1 | 3 | 136 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cabacinha | Cucurbitaceae | Luffa operculata (L.) Cogn. | Me | Me | Me | 6 | 6 | 1 | 325 |
| Caimbé | Dilleniaceae | Curatella americana L. | Me O | Me O | Me O | 25 | 2 | 13 | 104 |
| Caju | Anacardiaceae | Anacardium occidentale L. | Nu Me | Nu Me O | Nu Me | 68 | 50 | 35 | 5 |
| Camapú | Solanaceae | Physalis angulata L. | - | Nu | - | 0 | 1 | 0 | 334 |
| Canarana | Costaceae | Costus spicatus (Jacq.) Sw. | Me | Me | Me | 6 | 3 | 4 | 16 |
| Canela | Lauraceae | Cinnamomum zeylanicum Blume | Nu Me | Nu Me Sp | Nu Me O | 21 | 10 | 17 | 209 |
| Capim marinho, capim santo | Poaceae | Cymbopogon citratus (DC.) Stapf | Nu Me | Nu Me | Nu Me | 16 | 13 | 15 | 105 |
| Carambola | Oxalidaceae | Averrhoa carambola L. | Nu | - | | 2 | 0 | | 340 |
| Catinga de mulata | Lamiaceae | Aeollanthus suaveolens Mart. ex Spreng. | Me Sp | Me Sp | Me Sp | 14 | 10 | 10 | 82 |
| Cipó pucá | Vitaceae | Cissus verticillata (L.) Nicolson & C.E. Jarvis | Me | Me | Me Sp | 6 | 4 | 10 | 230 |
| Comigo ninguém pode, aninga pintada | Araceae | Dieffenbachia parvifolia Engl. | Sp | - | Sp | 2 | 0 | 2 | 323 |
| Copaíba | Fabaceae | Copaifera martii Hayne | Me | Me | Me | 3 | 4 | 17 | 342 |
| Coqueiro | Arecaceae | Cocos nucifera L. | Nu Me C Ir Ar Co O | Nu Me C Ir Ar Co O | Nu Me C Ir Ar Co O | 155 | 72 | 126 | 349 |
| Chama | Lamiaceae | Mentha piperita L. | Sp | Sp | Sp | 1 | 3 | 1 | 148 |
| Coramina | Euphorbiaceae | Pedilanthus tithymaloides (L.) Poit. | Me | Me | Nu Sp | 8 | 7 | 7 | 144 |
| Corrente | Amaranthaceae | Pfaffia glomerata (Spreng.) Pedersen | Me | Me | Me | 3 | 2 | 4 | 172 |
| Cuieira | Bignoniaceae | Crescentia cujete L. | Ir O | Co O | - | 2 | 2 | 0 | 181 |
| Desinflama | Crassulaceae | Kalanchoe sp. | Me | Me Sp | Me | 19 | 12 | 8 | 40 |
| Dinheiro em penca | Phyllanthaceae | Phyllanthus urinaria L. | - | - | Sp | 0 | 0 | 1 | 292 |
| Elixir parigório | Piperaceae | Piper callosum Ruiz & Pav. | Me | - | Me | 13 | 0 | 2 | 328 |
| Embaúba | Urticaceae | Cecropia obtusa Trécul | - | Me | - | 0 | 2 | 0 | 329 |
| Erva Cidreira | Verbenaceae | Lippia alba (Mill.) N.E.Br. ex Britton & P. Wilson | Me | Me | Nu Me Sp | 17 | 8 | 27 | 141 |
| Erva de jaboti | Amaranthaceae | Chenopodium ambrosioides L. | Me O | - | Me | 2 | 0 | 4 | 201 |
| Espada de são Jorge | Asparagaceae | Sansevieria trifasciata Prain | Sp | Sp | Sp | 3 | 1 | 5 | 300 |
| Favaca (alfavaca), favacão | Lamiaceae | Ocimum campechianum Mill. | Nu Co Me | Nu | Nu | 14 | 9 | 9 | 337 |
| Fedegoso | Boraginaceae | Heliotropium indicum L. | Me | - | - | 3 | 0 | 0 | 302 |
| Forsangue | Acanthaceae | Justicia polygonoides Kunth | Me | Me | Me | 4 | 1 | 3 | 270 |
| Gengibre | Zingiberaceae | Zingiber officinale Roscoe | Nu Me | Me | Nu Me | 7 | 3 | 5 | 59 |
| Genipapo | Rubiaceae | Genipa americana L. | Nu Me | Nu Co Me | Nu Me C | 15 | 4 | 10 | 127 |
| Goiabeira | Myrtaceae | Psidium guajava L. | Nu Me | Nu Me O | Nu Me | 12 | 12 | 39 | 22 |
| Graviola | Annonaceae | Annona muricata L. | Nu | Nu | Nu | 12 | 3 | 5 | 83 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Hortelã, hortelã do Maranhão, hortelã grande, hortelã da Índia | Lamiaceae | Plectranthus amboinicus (Lour.) Spreng. | Me | Nu Me | Me Sp | 18 | 18 | 17 | 177 |
| Hortelãzinho | Lamiaceae | Mentha spicata L. | Nu Me | Me | Nu Me Sp | 9 | 13 | 19 | 67 |
| Inajá | Arecaceae | Attalea maripa (Aubl.) Mart. | - | Nu | - | 0 | 1 | 0 | 345 |
| Ingá | Fabaceae | Inga edulis Mart. | - | Nu | - | 0 | 1 | 0 | 348 |
| Jambo | Myrtaceae | Eugenia malaccensis L. | - | Nu | Nu | 0 | 1 | 2 | |
| Japana, japana branca/roxa | Asteraceae | Ayapana triplinervis (Vahl) R.M.King & H.Rob | Me | Me Sp | Me | 11 | 6 | 5 | 186 352 |
| Jiboia | Araceae | Philodendron ecordatum Schott | Sp | - | - | 1 | 0 | 0 | 322 |
| Jucá | Fabaceae | Libidibia ferrea (Mart.) L.P. Queiroz | Me | Me | Me | 33 | 8 | 15 | 9 |
| Jurema | Fabaceae | Chloroleucon acacioides (Ducke) Barneby & J.W.Grimes | - | - | O | 0 | 0 | 1 | 306 |
| Lacre | Hypericaceae | Vismia guianensis (Aubl.) Choisy | Me | Me | Me | 2 | 1 | 1 | 187 |
| Lágrima de Nossa Senhora | Poaceae | Coix lacryma-jobi L. | - | - | Ar Me | 0 | 0 | 5 | 287 |
| Limão | Rutaceae | Citrus limonum Risso | Nu Me | Nu Me Sp | Nu Me C | 18 | 10 | 15 | 180 |
| Limão caena | Oxalidaceae | Averrhoa bilimbi L. | - | Nu O | - | 0 | 7 | 0 | 184 |
| Limão galego | Rutaceae | Citrus limon (L.) Osbeck | - | Nu Me Sp | - | 0 | 6 | 0 | 350 |
| Limão tangerina | Rutaceae | Citrus reticulata Blanco | - | - | Nu Me | 0 | 0 | 4 | 351 |
| Língua de vaca | Asteraceae | Elephantopus mollis Kunth | Nu | - | - | 1 | 0 | 0 | 53 |
| Lórnia | Asteraceae | Pluchea sagittalis (Lam.) Cabrera | - | Me | Me | 0 | 5 | 1 | 178 |
| Mangueiro | Rhizophoraceae | Rhizophora racemosa G. Mey | Me Co O Rn | Co Ir O | Co O | 40 | 10 | 7 | 129 |
| Manjericão | Lamiaceae | Ocimum minimum L. | Me Me | Nu Me Sp | Me Sp | 7 | 7 | 5 | 202 |
| Manjerona | Lamiaceae | Mentha sp. | Nu Sp | - | Me | 10 | 0 | 1 | 257 |
| Mão aberta | Araceae | Caladium bicolor (Aiton) Vent. | - | - | Sp | 0 | 0 | 1 | 341 |
| Maracujá | Passifloraceae | Passiflora edulis Sims | Nu Me | Nu | Nu | 3 | 3 | 5 | 313 |
| Maracujá selvagem/do mato | Passifloraceae | Passiflora acuminata DC. | - | Nu | - | 0 | 1 | 0 | 213 |
| Maria mole | Commelinaceae | Commelina virginica L. | Sp | Sp | - | 1 | 1 | 0 | 338 |
| Maria pretinha | Myrtaceae | Myrcia cuprea (O. Berg) Kiaersk. | Nu | - | - | 1 | 0 | 0 | 212 |
| Marupazinho | Iridaceae | Eleutherine plicata (Sw.) Herb. | Me | Me | Me | 4 | 3 | 4 | 163 |
| Mata pasto | Fabaceae | Senna reticulata (Willd.) H.S.Irwin & Barneby | Sp | - | Me Sp | 3 | 0 | 3 | 106 |
| Mastruz | Amaranthaceae | Disphania ambrosioides (L.) Mosyakin &Clemants | Me | Me | Me Sp | 12 | 6 | 16 | |
| Melão de são caetano | Cucurbitaceae | Momordica charantia L. | - | - | Me | 0 | 0 | 3 | 324 |
| Melhoral | Convolvulaceae | Evolvulus sericeus Sw. | Me | - | - | 2 | 0 | 0 | 258 |
| Miracelina | Amaranthaceae | Alternanthera brasiliana (L.) Kuntze | - | Me | Me | 0 | 2 | 14 | 142 |
| Mucurá caá | Phytolaccaceae | Petiveria alliacea L. | Me Sp | - | Me Sp | 0 | 11 | 4 | 315 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Muruci, murici | Malpighiaceae | Byrsonima crassifolia (L.) Kunth | Nu Me C Ar | Nu Me C O | Nu Ar O | 46 | 36 | 37 | 54 |
| Nim | Meliaceae | Azadirachta indica A. Juss. | Me | - | - | 20 | 0 | 0 | 13 |
| Noni | Rubiaceae | Morinda citrifolia L. | Me | Me | Me | 8 | 2 | 7 | 15 |
| Olho de boi | Fabaceae | Ormosia coutinhoi Ducke | Ar | - | Ar | 3 | 0 | 7 | 207 |
| Pai joaquim | Asteraceae | Rolandra fruticosa (L.) Kuntze | Me | - | Me | 3 | 0 | 2 | 309 |
| Pariri | Bignoniaceae | Fridericia chica (Bonpl.) L.G.Lohmann | Me | Me | Me | 3 | 1 | 3 | 109 |
| Paticholi | Poaceae | Vetiveria zizanioides (L.) Nash | - | - | Me | 0 | 0 | 1 | 317 |
| Pau de são sebastião, pau siri, pau de São Jorge | Euphorbiaceae | Euphorbia tirucalli L. | - | Me | - | 0 | 2 | 0 | 204 |
| Pião branco | Euphorbiaceae | Jatropha curcas L. | Me | Me | Me | 6 | 3 | 2 | 190 |
| Pião Roxo | Euphorbiaceae | Jatropha gossypiifolia L. | - | Me Sp | Sp | 0 | 4 | 15 | 10 |
| Pimenta de cheiro, pimenta de molho, pimenta malagueta | Solanaceae | Capsicum odoriferum Vell. | Nu Sp | Nu | Sp | 11 | 1 | 4 | 291 272 293 |
| Pimentinha da panela | Solanaceae | Capsicum annuum L. | Nu | - | - | 5 | 0 | 0 | 256 |
| Pirarucu | Crassulaceae | Kalanchoe pinnata (Lam.) Pers. | Me | Me | Me Sp | 20 | 8 | 9 | 17 |
| Pra marióba (pardemarióba) | Fabaceae | Senna sp. | - | - | - | 0 | 0 | 0 | 124 |
| Priprioca | Cyperaceae | Cyperus articulatus L. | Me O | - | - | 4 | 0 | 0 | 77 |
| Quebra pedra | Phyllanthaceae | Phyllanthus nururi L. | Me | Me | Me | 1 | 3 | 3 | 169 |
| Rosa madeira | Cactaceae | Pereskia grandifolia Haw. | Me | - | - | 3 | 0 | 0 | 277 |
| Sabugueiro | Adoxaceae | Sambucus nigra L. | Me | - | Me | 6 | 0 | 8 | 269 |
| Salsa | Fabaceae | Canavalia rosea (Sw.) DC. | - | Me | Me | 0 | 2 | 1 | 200 |
| Siriúba | Acanthaceae | Avicennia germinans (L.) L. | Co Ir Rn | Co Ir Ar | Co | 25 | 14 | 1 | 48 |
| Taboca | Poaceae | Bambusa superba (Huber) McClure | Co Ir Rn O | Co Ir | Co | 32 | 13 | 4 | 90 |
| Tajá de pena | Araceae | Anthurium gracile (Rudge) Lindl. | - | - | 2 | 0 | 0 | 2 | 316 |
| Taja roxo | Araceae | Philodendron muricatum Willd. ex Schott | - | - | 1 | 0 | 0 | 1 | 344 |
| Tento | Fabaceae | Abrus fruticulosus Wight & Arn. | Ar | - | Ar | 3 | 0 | 9 | 273 |
| Tinteiro | Combretaceae | Laguncularia racemosa (L.) C.F. Gaertn. | C Co Ir Rn | Co | Co | 28 | 4 | 2 | 128 |
| Tracuá | Araceae | Philodendron acutatum Schott | - | Me | - | 0 | 1 | 0 | 185 |
| Tucumã | Arecaceae | Astrocaryum vulgare Mart. | Nu Me Co Ir Ar Rn O | Nu Me Co C Ir Ar Rn O | Nu Co Me Co Ar O | 39 | 54 | 40 | 134 |
| Urucum | Bixaceae | Bixa orellana L. | Nu Me | Nu | Nu Me | 3 | 1 | 3 | 101 |
| Vassourinha | Plantaginaceae | Scoparia dulcis L. | Me Sp | Sp | Me Sp | 8 | 5 | 5 | 8 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Vassourinha-de-botão | Rubiaceae | Spermacoe verticilata L. | Me Sp | Sp | Me Sp | 7 | 4 | 6 | - |
| Verônica | Fabaceae | Spermacoe verticilata L. | Me | Me | Me | 26 | 12 | 18 | 123 |
| Vindicá menino | Zingiberaceae | Alpinia purpurata (Vieill.) K. Schum. | - | - | O | 0 | 0 | 2 | |
| Vinagreira | Malvaceae | Hibiscus sabdariffa L. | Nu | Nu | Nu | 13 | 9 | 8 | 110 |
| Vindicá menino | Portulacaceae | Talinum patens (Jacq.) Willd. | - | - | O | 0 | 0 | 1 | 319 |
| | | | | | | | | | |
| **Total: 115** | **49** | **115** | **-** | **-** | **-** | **1087** | **621** | **849** | **-** |

**CCU – Comunidade do Caju-Úna; PC – Povoado do Céu; VP – Vila do Pesqueiro; Me – medicinal use; Sp – spiritual use ; Nu – nutritional use; Ar – artisan use; Sp – spiritual use; Co – use in construction; Ir – use as insect repellent; O – other uses; C – commercial use; Rn – use as river navigation marker.**

In all three of the communities evaluated here, plants are routinely used as food, medicine, or insect repellent, as well as by artisans, in construction, as river navigation markers, and for spiritual purposes (Table 3). Lisboa (2012) reported that, in the Marajó region, natural resources as used as raw materials for the construction of dwellings, as food, and as medicine, as well as in the artisanal production of items for everyday use.

The most common use categories in the three communities evaluated were medicinal and nutritional (Fig. 2). In a study conducted in two areas of floodplain forest within the Ilha do Combu Environmentally Protected Area, also in the state of Pará, Rodrigues *et al.* (2006) showed that the most common use of the plant species in the area studied was medicinal. In the previously mentioned study conducted by Carneiro *et al.* (2010), in the Vila dos Pescadores community within the Caeté-Taperaçu RESEX-Mar, the nutritional and medicinal use categories were also predominant.

Reports of knowledge about the use of plants have indicated that such knowledge is passed down from generation to generation, primarily along the maternal line. Liporacci & Simão (2013) also observed the transmission of such knowledge from mothers and grandmothers. Women are repositories of information, principally information about the medicinal and nutritional use of plants, whereas men tend to possess more knowledge about the use of plants in construction and in creating river navigation markers. Simonian (2009) and Viu *et al.* (2010) reported that the plant resources of the Amazon are widely discussed by women, mainly in terms of their medicinal properties, which would be expected, given that women are traditionally viewed as being responsible for housework and other domestic activities, as well as caring for the health of family members (Di Ciommo, 2007).

***Medicinal uses of plant species***

In the Soure RESEX-Mar, we found that knowledge regarding the medicinal use of plants was passed from generation to generation, providing evidence of a long-standing cultural heritage of seeking alternative means of survival. According to Moreira *et al.* (2002), humans use plants as alternative therapies because valuable information regarding such therapies has been perpetuated, often within their own cultures. In the communities evaluated in the present study, the search for plant resources with medicinal properties was found to be related to the inefficiency of the local health care system and the distance from the nearest hospital, mainly for residents of CCU and PC, which impedes their access to specialized medical treatment. Such factors, coupled with cultural aspects, condition the use of medicinal plants as the main resources in the treatment of diseases. Christo *et al.* (2006) showed that the use of medicinal plants is increasingly more common in folk medicine, a fact primarily attributable to the high prices of medicines produced by large pharmaceutical companies, although also related to impaired access to the latter, which is due not only to their price but also to their limited distribution in rural areas.

**Table 3**
**Categories of use of plant species in the communities within the Soure Marine Extractive Reserve, in the state of Pará, Brazil.**

| Use category | Community | Description of use |
|---|---|---|
| | | |
| Nutrition | CCU/PC/VP | Species consumed as food: fresh fruit, juices, sweets, savory foods, and spices |
| Artisanal | CCU/PC/VP | Species used in the making of sculptures, picture frames, "biojewelry", tables, and fishing nets |
| River markers | CCU | Species used in delineating the areas of a river in which fishing is permitted |
| Commercial | CCU/PC/VP | Species sold in markets, mainly fresh fruit, oils and other bottled botanical products |
| Construction | CCU/PC/VP | Species used in the construction of fences, flooring, sties, fish traps, and racks for drying fish |
| Medicinal | CCU/PC/VP | Species used in the treatment of ailments, including respiratory, gastrointestinal, and cardiovascular disorders |
| Spiritual | CCU/PC/VP | Species used as talismans to protect homes, in the ceremonial blessing of children, and to produce spiritually purifying smoke |
| Insect repellent | CCU/PC/VP | Species burned in order to repel insects, mainly mosquitoes |
| Other | CCU/PC/VP | Species previously (and possibly currently) used in the kiln production of charcoal, as well as in the dyeing of boat sails |

**CCU – Comunidade do Caju-Úna; PC – Povoado do Céu; VP – Vila do Pesqueiro.**

**Figure 2**
**Number of species cited, by use category, in the communities within the Soure Marine Extractive Reserve, in the state of Pará, Brazil.**

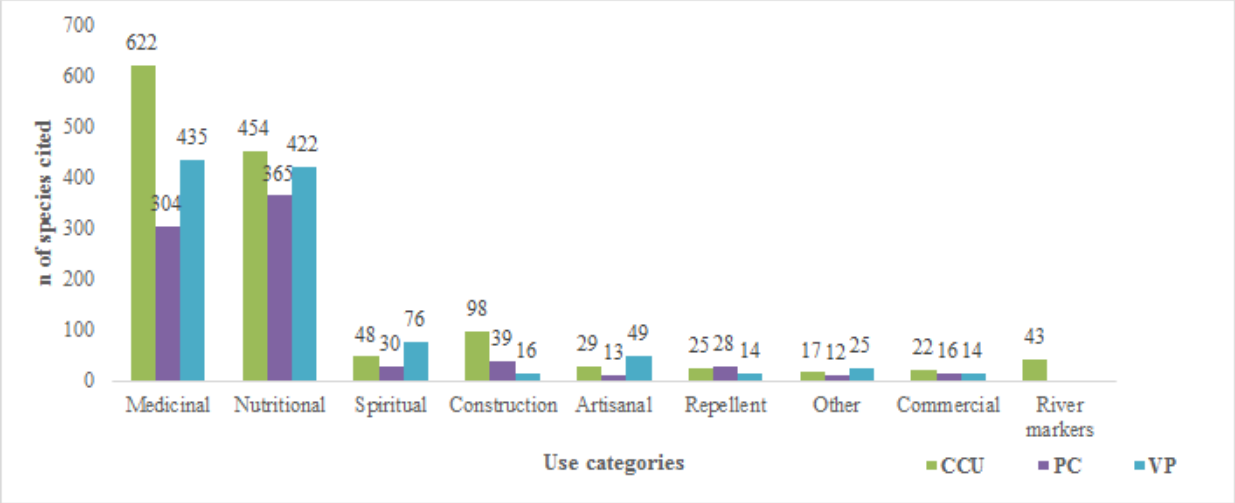



**Figure legends**
**CCU – Comunidade do Caju-Úna; PC – Povoado do Céu; VP – Vila do Pesqueiro.**

In the three communities evaluated here, the most widely used parts of the plants (within the medicinal use category) were the leaves (in 58% of the uses), followed by the outer/inner bark (in 19%). That tendency has also been observed in other studies conducted in the Amazon, as well as in studies conducted in the Atlantic Forest (Vendruscolo & Mentz, 2006; Coelho-Ferreira, 2009; Borges & Peixoto, 2009).

The most popular medicinal preparation among the residents of the Soure RESEX-Mar was tea, which accounted for 61%, 54%, and 58% of the uses in CCU, PC, and VP, respectively. This is in agreement with the findings of most other studies of medicinal plants realized in Brazil (Borba & Macedo, 2006; Negrelle & Fornazzari, 2007; Brasileiro *et al.*, 2008). In all three communities, it was common for a resident who cited a given medicinal plant species to allude to the corresponding commercial medicine, such as paregoric, ampicillin, amaranth, and terramycin, as well as the commercial cold remedies known as *melhoral* (*E. sericeus*) and *riforcina* (*A. brasiliana*). According to Moreira *et al.* (2002), this is due to the fact that the use of such plants is associated with that of certain synthetic medications.

***Nutritional uses of plant species***

Among the plant species used as foods, those most often cited by interviewees in all three of the communities evaluated were *coqueiro* (*C. nucifera*), *caju* (*A.occidentale*), and *muruci* (*B. crassifolia*). The fruits of those species are consumed fresh or in the form of juice or sweets. *caju* juice and *coco* milk are also used in cooking fish; *coco* milk is mixed with beans; and *caju* nuts are used in brittle and chocolate. *Caju* and *muruci* were also cited by Coelho-Ferreira & Jardim (2005) for the fishing communities of Marudá, also in the state of Pará, and by Fonseca-Kruel & Peixoto (2004), in a survey conducted in the municipality of Arraial do Cabo, in the state of Rio de Janeiro.

***Use of plant species in construction***

Among the plants used as construction materials in the three communities evaluated, those most often cited were *taboca* (*B. superba*), *tinteiro* (*L. racemosa*), *siriúba* (*A. germinans*), and *mangueiro* (*R. racemosa*). According to the interviewees, those species are used because they are easily found in the Soure RESEX-Mar. Carneiro *et al.* (2010) attributed the use of *mangueiro* to the fact that its wood is highly resistant to decomposition. Figueiredo *et al.* (2009) showed that, in the Mãe Grande de Curuçá ExR, also in the state of Pará, the wood extracted from *mangueiro* forests is used in the construction of fish traps.

***Sale of plant species***

The selling of plant species is an incipient activity in the three communities evaluated. The species most often sold by plant vendors are *muruci* (*B. crassifólia*) in CCU, dry coco (*C. nucifera*) mainly in VP but also in CCU and *bicho tucumã* oil (in all three communities). The residents reported having difficulty in selling plants that are widely available to anyone who lives in the area and knows where to find them. Lima (1986), Shanley & Medina (2005), and Menezes *et al.* (2012) cited sales of *bicho tucumã* oil as a source of extra income for residents of these same communities, because it has a high commercial value. In the Soure RESEX-Mar, one liter of the oil sells for as much as 100 Brazilian reals (approximately 50 American dollars). The popularity of *bicho tucumã* oil is due to its therapeutic uses, primarily in the treatment of inflammation.

***Use of plant species for spiritual purposes***

Plants referred to as "sacred" or "magical" (those serving spiritual or ceremonial purposes) are widely used in the Soure RESEX-Mar communities, because their uses are related to symbolisms and beliefs held by residents of all ages. Such plants are believed to protect against a variety of abstract ills, including bad luck, the "evil eye", and envy. Within this category, 76 species were cited for VP, compared with 49 for CCU and 30 for PC. The ethnobotanical species known locally (in Portuguese) as *espada de São Jorge* (*S. trifasciata*), *pião roxo* (*J. gossypiifolia*), *tajá de pena* (*A. gracile*), *comigo ninguém pode* (*D. parvifolia*), and *rio negro* are believed to protect dwellings and their inhabitants. Those species are therefore used as talismans to shield homes in the region against calamity.

The *benzedeiras* ("blessing givers") are persons in the communities who know the incantations/prayers believed to treat cultural ills. They often use *vassourinha de botão* (*B. verticillata*) to bless children thought to be suffering the effects of the "evil eye". In that ceremony, they pray for the child until the leaves of the plant begin to wilt. Cleansing baths and purifying smoke treatments are prepared by the users themselves; that is, no specific

individual is charged with those tasks. In a study of Catholicism and shamanism in the Amazon, Maués (2007) also cited various such curative techniques, including baths, smoke treatments, and blessings.

According to the residents of the three communities evaluated in the present study, *benzedeiras* were common in the past. However, during our field work, we were able to identify only a few such individuals, all of whom were former practitioners of these types of ceremonial acts. The residents indicated five women, ranging from 45 to 63 years of age, who were "retired" *benzedeiras*, one having giving up the practice for religious reasons, whereas the other four cited health problems as their reason for quitting. In the Amazon, there is a strong prohibition against the practice of shamanism by women (Faro, 2012), still according to the author, nevertheless, in many regions, female shamans are sought out, because they are considered more powerful than their male counterparts, as is the case in the city of Soure, where most of the healers, blessing givers, and midwives are women.

***Use of plant species by artisans***

Items created by artisans using local plant species were more widely produced and sold in VP, where there is a greater influx of tourists (Lobato *et al*., 2014). Among the interviewees, the residents of VP who produced such items reported using 49 species, compared with 29 cited by artisans in CCU and 13 cited by artisans in PC. The main category of product sold was "biojewelry", made from coconut shells and from the seeds of the plants known locally (in Portuguese) as *tento* (*A. fruticulosus*), *olho de boi* or *olho de boto* (*O. coutinhoi*), *araticum* (*A. glabra*), *lágrima de nossa senhora* (*C. lacryma-jobi*), *bandeide* (*E. polystachya*), *murici* (*B. crassifolia*), *tucumã* (*A. vulgare*), *seringueira* and *feijãozinho*. Carneiro *et al.* (2010) found that artisans in a similar community also fashioned jewelry from *muruci* seeds and tucuma palm pits, the latter also cited as having been used by artisans in the Brazilian Amazon (Shanley & Medina 2005).

***Use of plant species as river navigation markers***

The species used as river navigation markers included those known locally (in Portuguese) as *siriúba* (*A. germinans*), *taboca* (*B. superba*), *tinteiro* (*L. racemosa*), *mangueiro* (*R. racemosa*), *tucumã* (*A. vulgare*), and *açaizeiro* (*E. oleracea*). In a study conducted in the Pecém Industrial Complex and Port Facilities, in the city of Pecém, in the state of Ceará, Araujó *et al.* (2009) reported the use of this technique as a way of marking off areas of risk, indicating where fishing was not allowed, due to the port activities.

***Use of plant species as insect repellents***

The presence of hematophagous insects is very frequent in the communities and so the smoke that repels them can be produced by burning the dry branches of *coco* (*C. nucifera*), the nuts of *andiroba* (*C. guianensis*), the bark of the *breu* (*P. sp.*), or any other piece of dry wood. Shanley & Medina (2005) and Schmal *et al.* (2006) stated that *andiroba* and *breu* are powerful insect repellents, the latter producing an insect-repelling resin.

***Other uses of plant species***

Another use of native hardwoods in the Amazon is the production of charcoal in kilns. In the three communities evaluated here, the main species extracted for that purpose were *mangue vermelho* (*R. mangle*), *siriúba* (*A. schaueriana*), and *mangue branco* (*L. racemosa*). Although such charcoal production was banned over a decade ago, it reduced the population of these species in the area, causing serious environmental problems in the Soure RESEX-Mar. Despite the ban, we identified two charcoal kilns during our field investigations. Ferreira (2002) also reported this lack of commitment to preserving the environment of the Soure RESEX-Mar, identifying a number of kilns in which residents produced charcoal from mangrove forest hardwoods, chosen because of their high combustibility. In addition, Figueiredo *et al.* (2009) reported the use of such hardwoods for charcoal production in the neighboring Mãe Grande de Curuçá RESEX-Mar.

***Quantitative analysis***

The $SD_{tot}$ and $UE_s$ were, respectively, 38.49 and 0.25 for CCU; 38.84 and 0.29 for PC; and 36.78 and 0.27 for VP. The similar use equitability among the three communities indicates that there was relative uniformity in the study area, not only in terms of the distribution of species but also in terms of resident knowledge regarding their use, this finding is in agreement with those of Lima *et al.* (2012). According Lima *et. al.* (2000) high $UE_s$ values are generally indicative of areas that are relatively well preserved and in which the inhabitants possess considerable ethnobotanical knowledge.

The $ID_s$ value was identical for all three communities (0.03). That means that there was no difference in terms of the level of interviewee knowledge regarding the uses of the species cited, indicating that their uses had become standardized among the communities. This similarity of knowledge is due to the fact that the three communities are close to one another, sharing the same ecosystem, making use of the same species. In a study conducted in the state of Santa Catarina, Siminski *et al.* (2011) also found that there was no difference among neighboring communities in terms of the $ID_s$ value.

We found that the $UD_s$ values were high in all three of the communities evaluated: 0.99 in CCU; 0.97 in PC; and 0.96 in VP. Such high $UD_s$ values indicate that many plant species occurring in the study area are used by the residents on a regular basis and are highly valued locally. According to Vendruscolo & Mentz (2006), a greater number of uses of a given species, regardless of the use category, translates to a greater value of that species in the community involved.

In relation to the use consensus (UCs) the coconut palm was the species that reached the highest indexes in the three communities, reaching the maximum value in the community Vila do Pesqueiro (Table 4). Based on the number of informants and the level of agreement among them, consensus regarding the use of a given species shows the relative importance of that species within the community or communities studied (Friedman *et al,*. 1986). The high $UC_s$ value for the coconut palm in the three communities evaluated here is due to the great variety of uses to which the species can be put. *Coco* (*C. nucifera*) water is medicinal (used in treating dehydration); mature *coco* (used in cooking or eaten raw) provide nourishment for communities and animals; and *coco* fiber serves not only as an insect repellent but also as a raw material for artisans. For some species, the $UC_s$ value was zero, which indicates that, although those species might have been mentioned by one or more of the informants, there were no coinciding uses (Vendruscolo & Mentz, 2006). Use of the bamboo species known locally as *taboca* (*B. superba*), which is prohibited for large structures, was cited by few of the residents interviewed in the present study. In the study conducted by Amaral & Neto (2008), the $Uc_s$ value was over 60%.

**Table 4**
**Highest values of the consensus use of a species ($UC_s$) index for the communities within the Soure Marine Extractive Reserve, in the state of Pará, Brazil**

| **Comunidade do Caju-Úna** | | |
|---|---|---|
| **Local name** | **n of citations** | **UCs** |
| Andiroba | 19 | 0 |
| Arruda | 16 | -0,16 |
| Barbatimão | 17 | -0,11 |
| Caimbé (Cajueiro Brabo) | 13 | -0,32 |
| Caju | 23 | 0,21 |
| Canela | 8 | -1 |
| Coqueiro | 26 | 0,37 |
| Desinflama | 10 | 0,47 |
| Jucá | 16 | -0,16 |
| Pirarucu | 10 | -0,47 |
| Mangueira | 16 | -0,16 |
| Mangueiro | 22 | 0,16 |
| Muruci/Murici | 22 | 0,16 |
| Nim | 9 | -0,53 |
| Siriúba | 13 | -0,32 |
| Taboca | 22 | 0,16 |

| | | |
|---|---|---|
| Tinteiro | 16 | -0,16 |
| Tucumã | 17 | -0,11 |
| Verónica | 11 | -0,42 |
| **Total species: 19** | **306** | **-** |

| **Povoado do Céu** | | |
|---|---|---|
| **Local name** | **n of citations** | **UCs** |
| Andiroba | 9 | -0,31 |
| Boldo | 8 | -0,38 |
| Caju | 18 | 0,38 |
| Capim marinho/santo | 8 | -0,38 |
| Coqueiro | 19 | 0,46 |
| Hortelãzinho | 7 | -0,46 |
| Hortelã grande | 7 | -0,46 |
| Mangueira | 13 | 0 |
| Muruci/murici | 14 | 0,08 |
| Siriúba | 9 | -0,31 |
| Taboca | 10 | -0,23 |
| Tucumã | 20 | 0,54 |
| **Total species: 12** | **142** | **-** |

| **Vila do Pesqueiro** | | |
|---|---|---|
| **Local name** | **n of citations** | **UCs** |
| Andiroba | 11 | -0,21 |
| Arruda | 12 | -0,14 |
| Caju | 15 | 0,07 |
| Canela | 6 | -0,57 |
| Capim marinho/santo | 9 | -0,36 |
| Cariru/caruru | 12 | -0,14 |
| Coqueiro | 25 | 1 |
| Copaíba | 8 | -0,43 |
| Babosa | 9 | -0,36 |
| Barbatimão | 15 | 0,07 |
| Erva cidreira | 15 | 0,07 |
| Hortelã grande | 10 | -0,28 |
| Jucá | 8 | -0,43 |
| Goiabeira | 15 | 0,07 |
| Gerimum/abóbora | 6 | -0,57 |
| Limão | 6 | -0,57 |
| Mangueira | 6 | -0,57 |
| Mastruz | 6 | -0,57 |
| Miracelina | 12 | -0,14 |
| Pião roxo | 11 | -0,21 |
| Tucumã | 14 | 0 |
| Verônica | 13 | -0,07 |
| **Total species: 22** | **244** | **-** |

**CONCLUSION**The ethnobotanical inventory carried out, 215 plant ethnoespecies were collected from which 115 species were collected and identified. Based on the calculated indices, the high species diversity (SDot) showed the strong dependence of these communities on plants and the diversification of uses. Was observed that the distribution of the species occurs homogeneously throughout the three communities and residents have similar patterns of use of these resources. Thus, even though extractivist communities have as their main resource crab and fish, plants have great cultural importance as a medicinal, food, mystical, repellent and structural resource (building houses and river navigation markers). The application of the Participant Observation technique demonstrated that the way of life of these populations, linked to the use of plants, is the result of a rich and long accumulation of knowledge that has been transmitted to several generations.

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