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Phyto-resources of interest for tourism in the dry forests of the coastal region, Jipijapa, Manabí, Ecuador

Fitorecursos de interés para el turismo en los bosques secos de la región costa, Jipijapa, Manabí, Ecuador

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ABSTRACT

In order to identify the phyto resources of interest for tourism, existing in the dry forests of the coastal region, an ethnobotanical interview was conducted in 10 parishes of the Jipijapa canton, Manabí, Ecuador. It was obtained 246 species with at least one known use, belonging to 191 gender and 63 families. Uses were: material stock (373 species), environmental (175), medicinal (152) and edible (64). A single species may have more than one use.

Keywords: ethnobotanical survey; use of plants.

RESUMEN

Con el fin de identificar los fitorecursos de interés para el turismo, existentes en los bosques secos de la región costa, se realizó una entrevista etnobotánica en 10 parroquias del cantón Jipijapa, Manabí, Ecuador. Se obtuvieron 246 especies con al menos un solo uso conocido, pertenecientes a 191 géneros y 63 familias. Los usos fueron: materiales (373 especies), ambientales (175), medicinales (152) y alimenticias (64). Una sola especie puede tener más de un uso.

Palabras clave: entrevista etnobotánica; uso de plantas.

INTRODUCTION

The sustained growth of nature tourism is a key factor for many Latin American economies (Thompson *et al.*, 2018), in which most travelers visiting the area not only explore the streets of the cities, but also visit forests to see wildlife, walk through the mountains and appreciate the natural and cultural wonders offered by the region (Byrne and Byrne, 2015). An important part of the integration of biodiversity into tourism is to make the concept less abstract, linking it to the economic and social benefits it provides and linking nature tourism to environmental protection (Eshun and Tagoe-Darko, 2015).

It should be taken into account that the more tourists that visit an area, the greater the consumption of resources in the same, for this reason the tourism activities associated with biodiversity should be improved and the negative environmental impacts incorporated by the sector should be limited (Hall, 2010; 2015). The income generated by nature tourism can be used to value what the planet's biodiversity has to offer (Thompson *et al.*, 2018). This includes knowing the real importance of biodiversity and its landscapes as a key asset and a vital part of environmental quality and visitor attractiveness (Schismenos *et al.*, 2018).

In the area of Manabí, growing agricultural and livestock development is one of the main causes for the disappearance of a large part of the forests (Montilla and Pacheco, 2017). These effects on the vegetation cause a decrease in flora and fauna, for which little local information is available, due to the limited research work that has been carried out in the area. It is known that most species can become an important tourist attraction, such as *Encyclia angustiloba* Schltr which has a monument, being one of the ways to carry out actions that allow the conservation of species.

As the dry coastal forests of Ecuador are very visited by the national and international tourism, the objective of the work is to identify the phytorecources of interest for the tourism in the Jipijapa canton, province of Manabí and its possibilities of use by the present and future generations.

MATERIALS AND METHODS

The present ethnobotanical work was carried out in the province of Manabí, Ecuador. We worked in 10 parishes in Jipijapa canton, where three are urban (Dr. Miguel Morán Lucio, Manuel Inocencio Parrales y Guale, San Lorenzo de Jipijapa) and the rest are rural (America, El Anegado, La Unión, Julcuy, Pedro Pablo Gómez, Puerto Cayo, Membrillal) (Figure 1).



Fig. 1 - Area of study by parishes in Jipijapa canton, Manabí, Ecuador

The duration of the research was four years, from 2015 to 2018. It began with the bibliographic review: Aguirre *et al.*, (2006a); Aguirre *et al.*, (2006b) Pinargote *et al.*, (2016); Pita *et al.*, (2016); Cantos *et al.*, (2017) and Rosete *et al.*, (2016), Rosete *et al.*, (2018) which allowed the first listing of the species present in the dry forests of Manabí. Interviews were conducted with local residents in order to know the most

frequent uses of each species. For the selection of the sample, the criteria of Rosete and Ricardo (2015), on the availability of residents for research, the acceptance of the researcher and the presence of forests near the houses, were taken into account. For the category of medicinal and food use the criteria of De la Torre et al., (2008) were taken. Material uses include species used as timber and those used in handicrafts. The following were considered to be of environmental use.

As there is no record in the area of studies on the subject of species of interest to tourists, various models proposed in other ethnobotanical studies have been consulted by Barrau (1971), Mitchell *et al.*, (2008), Rosete and Ricardo (2015), Pinargote *et al.*, (2016), Pita *et al.*, (2016), Rosete *et al.*, (2016), Rosete *et al.*, (2018), Gibson (2018), Murundu and Cheikhyoussef (2018) and Nathen (2018), for the elaboration of the questionnaire, selecting those questions that fulfilled the posed objectives. The selection of the sample was not predetermined under any criteria of age, sex or occupation; a random selection was made. Due to the fact that people over 60 years of age are the ones with the greatest knowledge on the subject (Penco and Gordón, 2003), some of the interviews with them were repeated.

In addition, the Encyclopedia of Useful Plants of Ecuador (De la Torre et al., 2008) was consulted in order to determine other uses not reported in the interviews. The observation is another of the methods that allowed to obtain an attentive, rational, planned and systematic perception of the phenomena related to the objectives of the investigation; it was used to objectively verify the species that are in the area and their uses, as well as the form of preparation fundamentally in the manufacture of artisan objects. According to Alonso, (2003) is the data collection procedure that provides a representation of the reality of the phenomena under study. In the list of species only those that the population identified with at least one specific use of interest for tourism were considered.

For taxonomic identification, several Ecuadorian floristic catalogues were consulted, as well as botanical specialists Dr. Carlos Cerón Martínez, Central University of Ecuador: Herbarium Alfredo Paredes, Quito and Dr. Zhofre Aguirre Mendoza, National University of Loja. For the category of endangered species, the IUCN Red List (2019) of threatened species was used.

RESULTS AND DISCUSSION

The Tropical Dry Forest is considered one of the main tourist resources for the canton of Jipijapa, Manabí, Ecuador, where 246 species comprising 191 genera and 63 families were registered (Table 1), which have at least one known use that is of interest for tourism. There are 218 species of the *Magnoliopsida* class, indicating that it is the most widely represented by the number of species, which coincides with what was reported by Sierra, (1999), Aguirre (2012) and Grijalva *et al.*, (2012), because it is the most studied taxonomically.

Table 1. - Part used and use of species of interest for tourism in the dry forest of Jipijapa, Manabí, Ecuador.

Especies	Parte usada	Categoría antropocéntrica	Uso Material
<i>Abutilon mollissimum</i> (Cav.) Sweet	1	4	
<i>Achyranthes aspera</i> L.	1	3	

<i>Acmella alba</i> (L'Hér.) Jansen	8	2, 3, 4	
<i>Acnistus</i> <i>arborescens</i> (L.) Schltdl.	1	3	
<i>Adiantum capillus-</i> <i>veneris</i> L.	1	3	
<i>Adiantum</i> <i>raddianum</i> C. Presl	8	2	
<i>Ageratum</i> <i>conyzoides</i> L.	1	2, 3	
<i>Albizia guachapele</i> (Kunth) Dugand	8	1, 2, 4	1
<i>Albizia lebeck</i> (L.) Benth.	1, 3	1, 2, 3	1
<i>Albizia multiflora</i> (Kunth) Barneby & J.W. Grimes	3	1, 2	1
<i>Albizia saman</i> (Jacq.) Merr.	8	1, 2, 3	1
<i>Allium cepa</i> L.	2	3, 4	
<i>Allium</i> <i>schoenoprasum</i> L.	1, 2	3, 4	
<i>Aloe vera</i> (L.) Burm.f.	8	2, 3, 4	
<i>Aloysia citrodora</i> Palau	8	2, 3, 4	
<i>Alternanthera</i> <i>porrigens</i> (Jacq.) Kuntze	1	2, 3	
<i>Ambrosia</i> <i>cumanensis</i> Kunth	1	2, 3	
<i>Annona cherimola</i> Mill.	1, 3, 6	1, 2, 3, 4	1, 2
<i>Annona muricata</i> L.	1, 3, 6	1, 2, 3, 4	1, 2
<i>Annona reticulata</i> L.	1	1, 3, 4	1
<i>Apium graveolens</i> L.	1, 3	3, 4	
<i>Armatocereus</i> <i>cartwrightianus</i> (Britton & Rose) Backeb.	8	2	
<i>Attalea colenda</i> (O.F. Cook) Balslev & A.J. Hend.	3, 6	1, 2, 3, 4	1, 2
<i>Attalea maripa</i> (Aubl.) Mart.	1, 3, 7	1, 2, 3, 4	1
<i>Bactris gasipaes</i> Kunth	1, 3	1, 2, 3, 4	1, 2
<i>Bauhinia</i> <i>weberbaueri</i> Harms	1, 3	1, 2, 3	1
<i>Bignonia longiflora</i> Cav.	3	1, 2	1
<i>Bixa orellana</i> L.	1, 3, 6	2, 3, 4	
<i>Bonellia sprucei</i> (Mez) B. Ståhl & Källersjö	1	1	

<i>Brassia jipijapensis</i> Dodson & N.H.Williams	8	2	
<i>Bravaisia integerrima</i> (Spreng.) Standl.	3	1	1
<i>Brosimum alicastrum</i> Sw.	1, 3, 6	1, 3, 4	1, 2
<i>Bursera graveolens</i> (Kunth) Triana & Planch.	3	1, 2, 3	1
<i>Caesalpinia coriaria</i> (Jacq.) Willd.	1, 3, 6	1, 2, 3	1
<i>Calophyllum longifolium</i> Willd.	3	1, 2, 3	1
<i>Carica papaya</i> L.	6	2, 3, 4	
<i>Cascabela thevetia</i> (L.) H. Lippold	8	2	
<i>Cassia fistula</i> L.	8	1, 2, 3, 4	1, 2
<i>Castilloa elastica</i> Sessé	3	1, 2, 3	1
<i>Castilloa tunu</i> Hemsl.	8	1, 2, 3	1, 2
<i>Cavanillesia platanifolia</i> (Humb. & Bonpl.) Kunth	8	1, 2	1
<i>Cecropia maxima</i> Snethlage	8	1, 2, 3	1
<i>Cecropia peltata</i> L.	3	1, 2, 3	1
<i>Cedrela montana</i> J. Moritz ex Turczaninow	8	1, 2, 3	1
<i>Cedrela odorata</i> L.	8	1, 2, 3	1
<i>Ceiba lupuna</i> P.E.Gibbs & Semir	8	1, 2, 3	1
<i>Ceiba trichistandra</i> (A. Gray) Bakhuisen	8	1, 2, 3	1
<i>Celtis loxensis</i> C.C.Berg	8	1, 2	1
<i>Centrolobium ochroxylum</i> Rudd	8	1, 2,	1
<i>Chrysophyllum cainito</i> L.	6	1, 2, 3, 4	1, 2
<i>Chusquea scandens</i> Kunth	8	2	
<i>Cissus verticillata</i> (L.) Nicolson & C.E.Jarvis	6	3	
<i>Citharexylum gentryi</i> Moldenke	3	1, 2, 3	1
<i>Citrus aurantium</i> L.	6	1, 2, 3, 4	1, 2
<i>Citrus limon</i> (L.) Burm. fil.	6	1, 2, 3, 4	1, 2
<i>Citrus reticulata</i> Blanco	6	1, 2, 3, 4	1, 2

<i>Clitoria brachystegia</i> Benth.	8	2, 3	
<i>Cnidocolus aconitifolius</i> (Mill.) I.M.Johnst.	6	3	
<i>Coccoloba ruiziana</i> Lindau	3, 6	1, 4	1
<i>Cochlospermum vitifolium</i> (Willd.) Spreng.	8	1, 2, 3	1
<i>Coffea arabica</i> L.	8	2, 3, 4	
<i>Coffea canephora</i> Pierre ex A.Froehner	8	2, 3, 4	
<i>Cojoba arborea</i> (L.) Britton & Rose	8	1, 2, 3	1
<i>Coleus amboinicus</i> Lour.	6	3, 4	
<i>Colicodendron scabridum</i> (Kunth) Hutchinson	8	2	
<i>Cordia alliodora</i> (Ruiz & Pav.) Oken	3, 6	1, 3	1
<i>Cordia eriostigma</i> Pittier	3, 8	1, 2	1
<i>Cordia lutea</i> Lam.	3, 5	1, 2, 3	1
<i>Cordia macrantha</i> Chod.	3	1, 2	1
<i>Coriandrum sativum</i> L.70	1	3, 4	
<i>Costus scaber</i> Ruiz & Pav.	8	2, 3	
<i>Costus spicatus</i> (Jacq.) Sw.	1	2, 3	
<i>Crescentia cujete</i> L.	3, 6	1, 2, 3	1
<i>Croton wagneri</i> Müll.Arg.	8	2	
<i>Cupania cinerea</i> Poepp. & Endl.	8	1, 2	1
<i>Cuphea ignea</i> A. DC.	8	2	
<i>Cynometra bauhiniifolia</i> Benth.	8	1, 2	1
<i>Cynophalla flexuosa</i> (L.) J. Presl	8	2	
<i>Cyperus rotundus</i> L.	2	3	
<i>Delonix regia</i> (Hook.) Raf.80	8	1, 2, 3	1
<i>Derris utilis</i> (A.C.Sm.) Ducke	8	2	
<i>Dicliptera paposana</i> Phil.	8	2	
<i>Dilodendron costaricense</i> (Radlk.) A.H.	3	1	1

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<i>Dimerandra rimbachii</i> (Schltr.) Schltr	8	2	
<i>Dyschoriste quitensis</i> (Kunth) Kuntze	8	2	
<i>Dysphania ambrosioides</i> (L.) Mosyakin & Clemants	1	3, 4	
<i>Enterolobium schomburgkii</i> (Benth.) Benth.	8	1, 2	1
<i>Epidendrum bracteolatum</i> C. Presl	8	2	
<i>Eriotheca ruizii</i> (K. Schum.) A. Robyns	1, 3	1	1
<i>Eryngium foetidum</i> L.	1	3, 4	
<i>Erythrina megistophylla</i> Diels	8	1, 2	1
<i>Erythrina smithiana</i> Krukoff	8	1, 2	1
<i>Erythrina velutina</i> Willd.	8	1, 2, 3	1
<i>Erythroxylum glaucum</i> O E. Schulz.	8	2, 3	
<i>Espositoa lanata</i> (Kunth) Britton & Rose	8	2	
<i>Euphorbia leucocephala</i> Lott	8	2, 3	
<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch	8	2, 3	
<i>Euterpe precatoria</i> Mart.	8	1, 2, 3, 4	1, 2
<i>Ficus gomelleira</i> Kunth & Bouché	3	1, 2, 3	1
<i>Ficus insipida</i> Willd. 100	8	1, 2, 3	1
<i>Ficus obtusifolia</i> Kunth	8	1, 2, 3	1
<i>Ficus pertusa</i> L.	1, 3	1, 2, 3	1
<i>Fulcaldea laurifolia</i> (Humb. & Bonpl.) Poir.	8	2	
<i>Gallesia integrifolia</i> (Spreng.) Harms	3	1	1
<i>Geoffroea spinosa</i> Jacq	1, 3	1, 2, 4	1
<i>Gliricidia sepium</i> (Jacq.) Walp.	1	1, 2, 3	1
<i>Guadua angustifolia</i> Kunth	8	1, 2	2

<i>Guazuma ulmifolia</i> Lam.	1, 3	1, 2, 3	1
<i>Gustavia serrata</i> S.A.Mori	3	1	1
<i>Hampea</i> <i>platanifolia</i> Standl.	8	2	
<i>Handroanthus</i> <i>billbergii</i> (Bureau & K. Schum.) S.O. Grose	8	1, 2, 3	1
<i>Handroanthus</i> <i>chrysanthus</i> (Jacq.) S. O. Grose	8	1, 2, 3	1
<i>Handroanthus</i> <i>guayacan</i> (Seem.) S.O.Grose	8	1, 2, 3	1
<i>Handroanthus</i> <i>impetiginosum</i> (Mart. ex DC.) Mattos	8	1, 2, 3	1
<i>Hibiscus rosa-</i> <i>sinensis</i> L.	8	2, 3	
<i>Hibiscus syriacus</i> L.	8	2, 3	
<i>Inga edulis</i> Mart.117	8	1, 2, 3, 4	1, 2
<i>Inga fendleriana</i> Benth.	3	1, 2, 3	1
<i>Inga marginata</i> Willd.	3	1, 2, 3	1
<i>Inga oerstediana</i> Benth.	8	1, 2, 3	1
<i>Inga punctata</i> Willd.	8	1, 2, 3	1
<i>Inga sapindoides</i> Willd.	1, 3, 6	1, 2, 3	1
<i>Inga spectabilis</i> (Vahl) Willd.	3, 6	1, 2, 3, 4	1, 2
<i>Ipomoea</i> <i>pauciflora</i> M. Martens & Galeotti	3	1	1
<i>Jacaranda</i> <i>mimosifolia</i> D. Don	8	1, 2	1
<i>Jatropha</i> <i>nudicaulis</i> Benth.	8	2	
<i>Kalanchoe pinnata</i> (Lam.) Pers.	8	2, 3	
<i>Lantana horrida</i> subsp. <i>tiliifolia</i> (Cham.) R.W.Sanders	8	2	
<i>Lasiacis ruscifolia</i> (Kunth) Hitchc. ex Chase	8	2	
<i>Laurus nobilis</i> L.	1, 3	1, 2, 3, 4	1, 2
<i>Leucaena</i> <i>leucocephala</i> (Lam.) de Wit	7	2, 3, 4	
<i>Leucaena</i> <i>trichodes</i> (Jacq.)Benth.	8	2	

<i>Lonchocarpus atropurpureus</i> Benth.	8	2	
<i>Loxopterygium huasango</i> Spruce ex Engl.	3	1	1
<i>Luma apiculata</i> (A. P. de Candolle) Burret	1, 3, 6	1, 3, 4	1
<i>Machaerium millei</i> Standl	3, 6	1, 3	1
<i>Maclura tinctoria</i> (L.) D. Don ex Steud.	8	1, 2, 3	1
<i>Macroclinium manabinum</i> (Dodson) Dodson	8	2	
<i>Macrolobium acaciifolium</i> (Benth.) Benth.	3	1	1
<i>Malpighia emarginata</i> DC.140	6	2, 3, 4	
<i>Mammea americana</i> L.	8	1, 2, 3, 4	1, 2
<i>Mangifera indica</i> L.	3, 6	1, 2, 3, 4	1, 2
<i>Manihot esculenta</i> Crantz	2	3, 4	
<i>Manilkara zapota</i> (L.) P.Royen	3, 6	1, 2, 3, 4	1, 2
<i>Matisia alata</i> Little	3	1	1
<i>Matisia cordata</i> Humb. & Bonpl.	3, 6	1, 4	1
<i>Mauria heterophylla</i> Kunth	3, 6	1, 3	1
<i>Mauria membranifolia</i> A. Barfod & L.B. Holm-Nielsen	3	1	1
<i>Mentha spicata</i> L.	1	2, 3, 4	
<i>Mentha suaveolens</i> Ehrh.150	1	2, 3, 4	
<i>Miconia aeruginosa</i> Naud.	8	2	
<i>Miconia quadripora</i> J.J. Wurdack	8	2	
<i>Mimosa albida</i> Willd.	8	2	
<i>Mirabilis jalapa</i> L.	8	2, 3	
<i>Muntingia calabura</i> L.	8	2, 3, 4	
<i>Myrcianthes discolor</i> (Kunth) McVaugh	8	2	
<i>Myroxylon balsamum</i> (L.)Harms	8	1, 2, 3	1, 2

<i>Myroxylon periferum</i> L. f	3	1	1
<i>Myrtus communis</i> L.	8	2, 3	
<i>Nectandra acutifolia</i> (Ruiz & Pav.) Mez	3	1	1
<i>Nectandra membranacea</i> (Sw.) Griseb.	3, 6	1, 3	1
<i>Ochroma pyramidale</i> (Cav. Ex Lam.) Urb.	3, 1	1, 2	1, 2
<i>Ocimum basilicum</i> L.	1	2, 3, 4	
<i>Ocotea cernua</i> (Nees) Mez	3	1	1
<i>Ocotea moschata</i> (Meisn.) Mez	8	1, 3	1
<i>Ocotea spixiana</i> (Nees) Mez	3	1	1
<i>Oncidium estradae</i> Dodson	8	2	
<i>Ophryosporus peruvianus</i> (Gmel.) R. King & H. Rob.	8	2	
<i>Opuntia ficus-indica</i> (L.) Mill.	1	2, 3, 4	
<i>Opuntia pubescens</i> H. L. Wendl. ex Pfeiff.	8	2	
<i>Origanum vulgare</i> L.	1	3, 4	
<i>Pappobolus acuminatus</i> (S.F. Blake) J.L. Panero	8	2	
<i>Passiflora sprucei</i> Mast.	8	2, 3	
<i>Persea americana</i> Mill.	3, 6	1, 2, 3, 4	1, 2
<i>Physalis philadelphica</i> Lam.	6	3, 4	
<i>Phytelephas aequatorialis</i> Spruce	8	1, 2	1, 2
<i>Pilosocereus tweedyanus</i> (Britton & Rose) Byles & G.D. Rowley	8	2	
<i>Piper aduncum</i> L.	1, 3, 6	1, 2, 3, 4	1, 2
<i>Piscidia carthagenensis</i> Jacq.	3	1	1
<i>Pisonia aculeata</i> L.	3	1, 3	1
<i>Pithecellobium excelsum</i> (Kunth) Mart.	8	1, 2	1
<i>Plantago major</i> L.	1	3	

<i>Platymiscium pinnatum</i> (Jacq.) Dugand	3	1	1
<i>Pouteria campechiana</i> (Kunth) Baehni	3, 6	1, 2, 3, 4	1, 2
<i>Pouteria sapota</i> (Jacq.) H.E. Moore & Stearn	3, 6	1, 2, 3, 4	1, 2
<i>Pradosia montana</i> T.D. Penn.	3	1	1
<i>Præceres euchlorus</i> (F.A.C. Weber ex K. Schum.) N.P. Taylor	8	2	
<i>Prestoea acuminata</i> (Willd.) H.E. Moore	3, 6	1, 3, 4	1
<i>Prestonia mollis</i> Kunth	8	2	
<i>Prioria copaifera</i> Griseb.	8	1, 2	1
<i>Prosopis juliflora</i> (Sw.) DC.	3, 6	1, 3	1
<i>Prosopis pallida</i> (Willd.) Kunth	8	1, 2	1
<i>Pseudobombax millei</i> (Standl.) A. Robyns	3, 6	1	1
<i>Pseudognaphalium bourgovii</i> (A. Gray) Anderb.	5	3	
<i>Psidium guajava</i> L.	1, 2, 6	2, 3, 4	
<i>Psychopsis krameriana</i> (Rchb. f.) H.G. Jones	8	2	
<i>Psychotria horizontalis</i> Sw.	8	2, 3	
<i>Quassia amara</i> L.	3	3	
<i>Rauvolfia tetraphylla</i> L.	1, 3, 6	3	
<i>Renealmia alpinia</i> (Rottb.) Maas	6	3, 4	
<i>Rhizophora mangle</i> L.	3	1, 3	1
<i>Ruta chalepensis</i> L.	1	3	
<i>Ruta graveolens</i> L.	8	2, 3	
<i>Sapindus saponaria</i> L.	8	1, 2, 3	1, 2
<i>Sarcomphalus thyrsiflorus</i> (Benth.) Hauenschild	8	2	
<i>Schinopsis balansae</i> Engl.	3, 2	1, 3	1
<i>Schizolobium parahyba</i> (Vell.) S.F. Blake	8	1, 2	1, 2

<i>Scoparia dulcis</i> L.	6	3	
<i>Sedum morganianum</i> Walther	8	2	
<i>Senna macranthera</i> (Collad.) H.S. Irwin & Barneby	8	1, 2	1
<i>Senna mollissima</i> (Willd.) H.S. Irwin & Barneby	3, 5	1, 3	1
<i>Sida rhombifolia</i> L.	1	3	
<i>Simira ecuadorensis</i> (Standl.) Steyererm.	3	1	1
<i>Sobralia powellii</i> Schltr	8	2	
<i>Solanum erianthum</i> D. Don	6	3	
<i>Solanum melongena</i> L.	6	3, 4	
<i>Solanum nigrum</i> L.	6	3, 4	
<i>Solanum sessiliflorum</i> M.F. Dun.	1	3, 4	
<i>Spondias purpurea</i> L.	3, 6	1, 3, 4	1
<i>Styrax subargenteus</i> Sleumer	3	1, 3	1
<i>Swietenia macrophylla</i> G. King	3	1, 2, 3	1
<i>Symphytum officinale</i> L.	3, 6	3	
<i>Syzygium jambos</i> (L.) Alston	3, 5, 6	1, 2, 3, 4	1, 2
<i>Tagetes erecta</i> L.	8	2, 3	
<i>Tamarindus indica</i> L.	3, 6	1, 2, 3, 4	1, 2
<i>Tecoma castanifolia</i> (D. Don) Melchior	8	2	
<i>Tectona grandis</i> L.f.	3	1, 2, 3	1
<i>Terminalia valverdeae</i> A.H. Gentry	3	1	1
<i>Tetramerium nervosum</i> Nees	6	3	
<i>Thunbergia alata</i> Boj. ex Sims	8	2, 3	
<i>Trema micrantha</i> (L.) Bl.	3, 6	1, 2, 3	1
<i>Trichilia hirta</i> L.	1	2, 3	
<i>Triplaris cumingiana</i> Fisch. & Mey. ex C. A. Mey.	8	1, 2	1

<i>Triumfetta althaeoides</i> Lam.	8	2	
<i>Vaccinium laurifolium</i> (Bl.) Miq.	8	2	
<i>Vachellia farnesiana</i> (L.) Wight & Arn.	8	2, 3	
<i>Vachellia macracantha</i> (Humb. & Bonpl. ex Willd.) Seigler & Ebinger	4	2, 3	
<i>Varronia macrocephala</i> Desv.	8	2	
<i>Verbena litoralis</i> Kunth	1	2, 3	
<i>Verbena officinalis</i> L.	1	2, 3	
<i>Verbesina minuticeps</i> S.F.Blake	8	2	
<i>Vernonanthura patens</i> (Kunth) H. Rob.	1	2, 3	
<i>Vitex gigantea</i> Kunth	1, 3	1, 2, 3, 4	1, 2
<i>Zanthoxylum sprucei</i> Engl.	3	1, 2	1
<i>Zea mays</i> L.	8	4	
<i>Zygostates apiculata</i> (Lindl.) Toscano	8	2	

Legend: Used part: 1 (leaf, bract or bud), 2 (root, rhizome or tuber), 3 (stem), 4 (stem bark), 5 (bud, flower, pollen, inflorescence), 6 (fruit, infructescence), 7 (seed, spore), 8 (complete plant). Anthropocentric category: 1 (material), 2 (environmental), 3 (medicinal), 4 (food). Material use: 1 (timber), 2 (handicraft)

It is followed in order by *Liliopsida* (26 species) and *Polypodiopsida* (two). The latter has very ornamental species: *Adiantum capillus-veneris* and *Adiantum raddianum*, observed in the gardens of most homes and tourist centers. *Adiantum capillus-veneris* is also recommended as a medicinal, to combat respiratory system conditions, such as bronchitis, in infusion of its aerial parts.

The botanical families with the greatest number of species are eighteen (18), including legumes (46 species). It is followed in descending order by *Malvaceae* (15), *Asteraceae* (10), *Bignoniaceae* (8), *Moraceae* (8), *Orchidaceae* (8), *Lamiaceae* (7), *Lauraceae* (7), *Anacardiaceae* (6), *Arecaceae* (6), *Cactaceae* (6), *Euphorbiaceae* (6), *Rutaceae* (6), *Solanaceae* (6), *Acanthaceae* (5), *Ehretiaceae* (5), *Myrtaceae* (5), *Sapotaceae* (5) and *Verbenaceae* (5) (Figure 2). De la Torre et al, (2008) obtained that the most represented families of useful plants for Ecuador are *Fabaceae*, *Asteraceae*, *Rubiaceae*, *Poaceae*, *Melastomataceae*, *Solanaceae*, *Araceae*, *Euphorbiaceae*, *Piperaceae*, *Arecaceae*, *Lauraceae*, *Gesneriaceae*, *Moraceae*, *Orchidaceae*, *Rosaceae*, *Urticaceae*, *Lamiaceae*, *Apocynaceae*, *Ericaceae*, *Myrtaceae*, *Annonaceae*, *Bromeliaceae*, *Clusiaceae*, *Sapotaceae*, *Sapindaceae*, *Malvaceae*, *Meliaceae*, *Acanthaceae*, *Amaranthaceae* and *Verbenaceae*. These results confirm what was said by Aguirre and Kvist (2005) Aguirre and Kvist, (2009), Aguirre et al.,

(2006a) and Aguirre *et al.*, (2006b), Pinargote *et al.*, (2016), Pita *et al.*, (2016), Cantos *et al.*, (2017) and Rosete *et al.*, (2016); Rosete *et al.*, (2018) in which these are the families with the highest number of useful plants and which are widely represented in the dry forests of Ecuador.

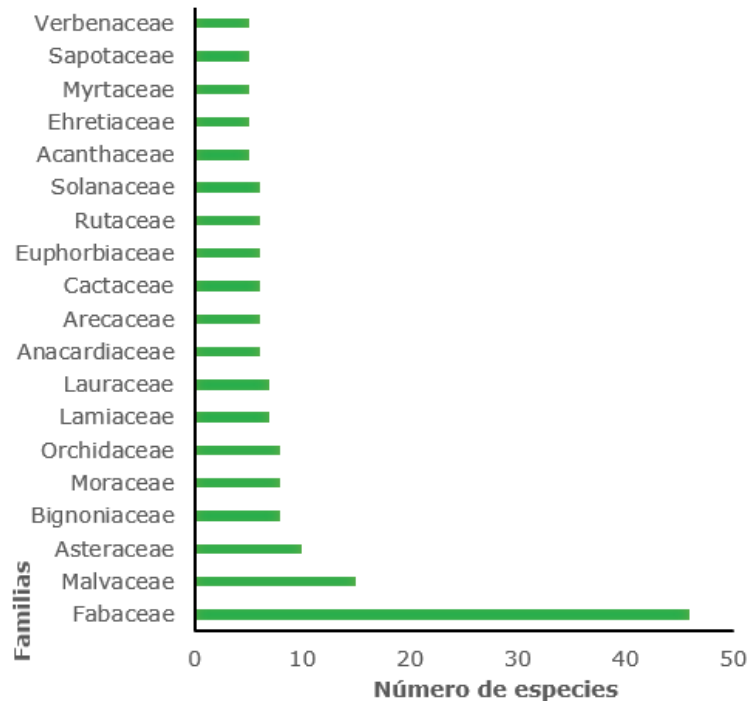


Fig. 2 - Species by botanical family present in the dry forests of Jipijapa canton, Manabí, Ecuador

In relation to the biological forms of the plants used, we have the following: trees (126 species), shrubs (59), herbs (52) and epiphytes (eight). There is a strong interrelationship between the information provided by the population and that reported in the Encyclopedia of Useful Plants of Ecuador (De la Torre *et al.*, 2008), in terms of most uses of the species; a total of 212 wild species and 34 cultivated species of interest to tourists were mentioned. These species are grouped into the following anthropocentric categories: materials (373 species), environmental (175), medicinal (152) and food (64) (Figure 3), where a species may have more than one use. These species are considered the main tourist attraction in the tropical dry forest of Jipijapa. In the case of the species used as materials, 245 are used for handicrafts and 128 for timber.

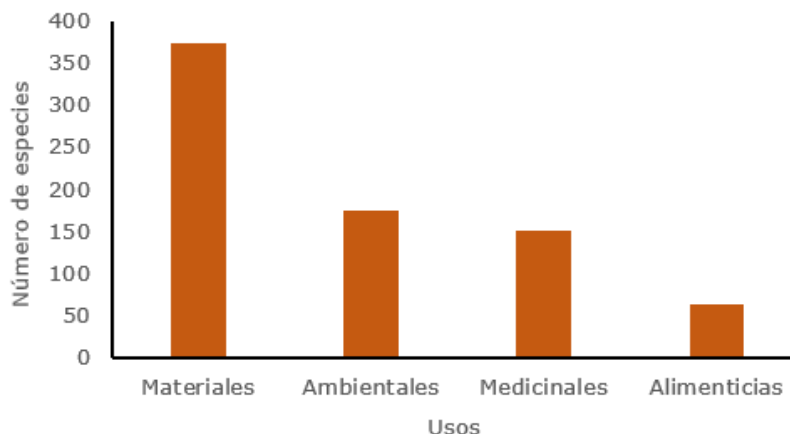


Fig. 3 - Species by uses present in the dry forests of Jipijapa canton, Manabí, Ecuador

Within the cultural vegetation, the species cultivated in the different agroforestry systems, of interest for subsistence feeding, but which usually sell their surpluses, where the main harvest now collected is *Zea mays*. They also invented *Carica papaya*, *Mangifera indica* and *Tamarindus indica*, which with their fruits make juices for sale in restaurants in the area. In the patios of the houses are the species *Hibiscus syriacus* and *Hibiscus rosa-sinensis* with its beautiful flowers, very striking throughout the year.

Not all wild species are used with the same intensity. According to the interviews, the *Fabaceae* family species of greatest interest to the residents were *Cassia fistula* and *Inga spectabilis*, since they are abundant in anthropized ecosystems, and from which they collect their seeds to make handcrafted objects. Among the *Malvaceae* there are species whose beauty adorn the landscape and make them unique to the sight of tourists, such as *Cavanillesia platanifolia*, *Ceiba trischistandra*, *Eriotheca ruizii*, *Guazuma ulmifolia*, *Matisia cordata*, *Ochroma pyramidale* and *Pseudobombax millei*.

Other species most mentioned for their environmental uses (ornamental) turned out to be the popularly called "orchids", all species belong to the family *Orchidaceae* (eight species). The most interesting for tourists, due to their rarity in the ecosystem and their beauty in the dry forests, are *Brassia jipijapensis*, *Macroclinium manabinum* and *Zygostates apiculata*. The *Arecaceae* (six species) is a family whose species are known as "palms", very ornamental and important in the coastal lowlands, heavily deforested and populated. The species reported as most interesting for tourism are *Euterpe precatória*, *Phytelephas aequatorialis* and *Prestoea acuminata*.

An analysis of the bibliography of IUCN's endangered species (2019) showed that 57 species are threatened, mainly by the destruction and fragmentation of their habitat. Treatment is of minor concern (36 species), endangered (7), vulnerable (6), data deficient (4) and at lesser risk (4) (Figure 4). The field trip allowed observing little or no natural regeneration of these species.

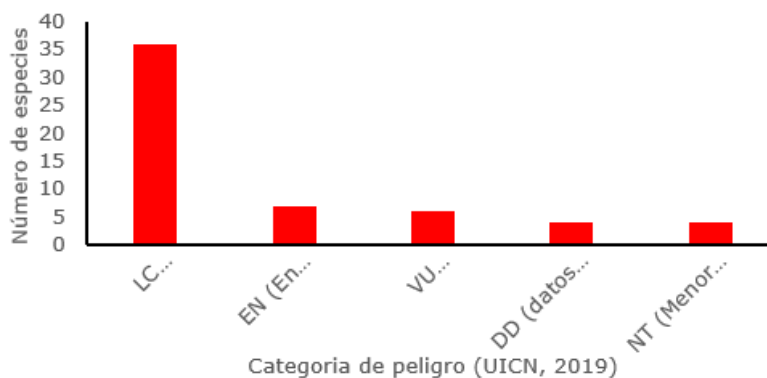


Fig. 4 - Species by category of danger present in the dry forests of Jipijapa canton, Manabí, Ecuador

The interviewed population states that the listed species have few individuals in the area, which coincides with what was reported in the endangered species database of the International Union for the Conservation of Nature (IUCN, 2019). The main threat to the *Phytelephas aequatorialis* palm is overexploitation of the seed. It was observed that natural regeneration is scarce and most of the specimens are cultivated in agroforestry farms. Bernal and Sanín (2013) raised the need to implement preventive measures and undertake the rehabilitation of deforested areas to ensure generational replacement, since similar results were obtained for the emblematic species *Ceroxylon quindiuense* (H. Karst.) H. Wendl., declared national tree of Colombia.

It should be noted that despite recognizing that these species are threatened, no actions have been established to guarantee their conservation. Very few studies have been carried out on the location of their populations, most of them related to forest species in coffee ecosystems (Velez and Olivera, 2013; Santistevan *et al.*, 2014), natural ecosystems (Cevallos *et al.*, 2017) and non-timber forest products (Pionce-Andrade *et al.*, 2018). Other studies are based on in vitro reproduction of *Handroanthus billbergii*, *Handroanthus chrysanthus* and *Myroxylon balsamum*, which are endemic forest species of the dry forest of the coast of Ecuador and Peru (Indacochea *et al.*, 2017; 2018).

The most important plant resources were determined due to their multiple uses: *Annona cherimola*, *Annona muricata*, *Attalea colenda*, *Bactris gasipaes*, *Cassia fistula*, *Chrysophyllum cainito*, *Citrus aurantium*, *Citrus limón*, *Citrus reticulata*, *Euterpe precatoria*, *Inga edulis*, *Inga spectabilis*, *Laurus nobilis*, *Mammea americana*, *Mangifera indica*, *Manilkara zapota*, *Persea americana*, *Piper aduncum*, *Pouteria campechiana*, *Pouteria sapota*, *Syzygium jambos*, *Vitex gigantea* and *Tamarindus indica* are presented in the four anthropocentric categories.

The inventory of plant resources presents in the dry forests of Jipijapa canton, Manabí, includes a total of 246 species comprising 191 genera and 63 botanical families that are of interest to tourism. The best represented botanical families are *Leguminosae*, *Malvaceae*, *Asteraceae*, *Bignoniaceae*, *Moraceae*, *Orchidaceae*, *Lamiaceae*, *Lauraceae*, *Anacardiaceae*, *Arecaceae*, *Cactaceae*, *Euphorbiaceae*, *Rutaceae*, *Solanaceae*, *Acanthaceae*, *Ehretiaceae*, *Myrtaceae*, *Sapotaceae* and *Verbenaceae*. There were found 212 species that correspond to wild taxa, while 34 are cultivated.

The species are divided into the following categories: material (373 species), environmental (175), medicinal (152) and food (64).

The most important vegetal resources due to their multiple uses are: *Annona cherimola*, *Annona muricata*, *Attalea colenda*, *Bactris gasipaes*, *Cassia fistula*, *Chrysophyllum cainito*, *Citrus aurantium*, *Citrus limón*, *Citrus reticulata*, *Euterpe precatoria*, *Inga edulis*, *Inga spectabilis*, *Laurus nobilis*, *Mammea americana*, *Mangifera indica*, *Manilkara zapota*, *Persea americana*, *Piper aduncum*, *Pouteria campechiana*, *Pouteria sapota*, *Syzygium jambos*, *Vitex gigantea* and *Tamarindus indica*.

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