

Ceiba pentandra L. Gaertn. (Malvaceae) and associated species: Spiritual Keystone Species of the Neotropics

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Abstract :

Among the 18 species included in the *Ceiba* genus, in the Malvaceae (Bombacoideae) family, *Ceiba pentandra* L. Gaertn. is not only the tallest and most widespread, but also occupies the most prominent place in Neotropical cosmovisions. In this ethnobotanical review, we compare perceptions and uses of *Ceiba* and related species across indigenous and Afro-descendant cultures ranging from the Caribbean to the Argentinian Chaco. *Ceiba*'s widely-shared role as axis mundi, (particularly in Amazonia) psychopomp and shelter of major forest spirits makes it a perfect example of a Spiritual Keystone Species, a new concept inspired from Cultural Keystone Species and defined here for the first time.

Keywords : Ethnobotany, Amazonia, Caribbean, lupuna, samauma, mapou, silk cotton tree, fromager, kapok

Introduction

To anyone living or travelling in most parts of the Neotropics or the Caribbean, it is impossible not to notice a majestic tree, its branches crowded with epiphytes and intermingled lianas, bordering Amazonian streams, emerging from distant hills in Caribbean islands, or simply preserved in parking lots in urban areas. Among the 16 000 or so Amazonian tree species (Ter Steege et al., 2016), one effectively looms above the rest: *Ceiba pentandra* L. Gaertn. This prominent tree from the Malvaceae (Bombacoideae) family is probably the most well-known (and widespread) representative of the *Ceiba* Mill. genus, and is an important cultural species in the Neotropics. From the perspective of interrogating transversalities and cultural hybridizations across human cultures, this species stands at a meeting point, and we decided to explore in depth the relationships between Amazonian, Central American and Caribbean cultures and the *Ceiba* tree. As a consequence of different logics between folk and Linnaean classifications (Berlin, 1993), the so called “silk-cotton tree” that occupies a key place in most cosmovisions ranging from Central America to the Cerrado in Brazil, actually represents a group of several species, some of which are sympatric, and of which the most widespread is *C. pentandra*. Although this paper mostly focuses on that species, the others, and their associated local knowledge, are included in this discussion to allow a more global view of the place of these peculiar trees.

The *Ceiba* genus contains 18 species in the Neotropics, grouped into taxonomic sections *Ceiba* and *Campylanthera* (Schott & Endl.) K. Schum (Pezzini et al., 2021). With the exception of a few *Cerrado* species, the majority are large trees, often with spines along the trunk and branches, and frequently with large buttresses. Leaves are palmate with 3-7 leaflets. Flowers are actinomorphic, with five petals, red, pink, yellow or white depending on the species, and from 2/3 to 15 cm. *C. pentandra* is the tallest, frequently emerging above the canopy (up to

70m high, Picture 1), and developing large buttresses bearing conical prickles. Flowers are pentamerous, small (2-3cm), white, and its seven foliolated leaves are glabrous. The fruit is a capsule (12-24 cm long), containing seeds surrounded by long, wooly, non-wettable hairs called kapok (Dick et al., 2007; Mori et al., 2002). *Ceiba* spp. range from seasonally dry tropical forests to tropical forests, and from Mexico (North) to Argentina (South) (Figure 1). *C. lupuna* P.E. Gibbs & Semir is the only species restricted to rain forests. *C. pentandra*, *C. samauma* (Mart.) K. Schum. and *C. speciosa* (A. St.-Hil.) Ravenna are mostly present in rain forests, while the other species are more widespread in seasonally dry forests (Pezzini et al., 2021). *C. pentandra* is also naturally present in equatorial Africa, and naturalized in all the humid tropics after human introduction (<https://www.gbif.org/species/5406697>). It originated from the Neotropics, and seeds probably dispersed to Africa by floating over the Atlantic Ocean (Dick et al., 2007).

Questioning inhabitants about these trees, one rapidly understands that they bear something unique. We first noticed this through years of fieldwork in collaboration with Amazonian and Caribbean peoples, and as we started reviewing the literature about *Ceiba* spp., it became clear that this species represents a very good example, in this vast region of the world, of a Cultural Keystone Species (Garibaldi and Turner, 2004). But unlike most keystone species, *Ceiba* is not an edible plant and is minimally used in medicine, technology and craft (although kapok fibers have an undeniable technical and economic interest). To better explain the cultural centrality of *Ceiba* spp., we thus decided to develop the concept of a "Spiritual Keystone Species" to describe the importance of the silk cotton tree in Neotropical cosmovisions.

Material and method

A thorough review of our personal Neotropical anthropological and ethnobotanical literature was conducted by searching for all the Linnaean names related to *Ceiba* (*Chorisia*, *Bombax*, etc.), as well as the most common folk names (*fromager*, *lupuna*, *mapou*, *paineira*, *samaúma*, etc.). Additional literature was gathered from Scopus, J-Stor and Google scholar with the same keywords. To this review of the literature, we added notes taken during our own field observations, mostly in Amazonia, the Guiana shield and the Caribbean. Linnean names were updated according to APG IV (The Angiosperm Phylogeny Group, 2016) via the Taxonomic Name Resolution Service (Boyle et al., 2013).

Results and discussion

A founding and shamanic tree among Indigenous cultures

From Central America to the Argentinian Chaco, the genus *Ceiba* shares a singular place in cosmovisions. The firsts synthetic writings on indigenous cultures of the Guiana shield, by authors such as Roth (1915) or de Goeje (1943) showed the cultural importance of this tree. For the Akawaio, Makusi and Arawak from Guyana, all beings were created from pieces of wood or bark of this tree, which was thrown from the top of a large *Ceiba* (on land or in the water) by a demiurge, thus creating birds, terrestrial and aquatic beings as well as men and women (de Goeje, 1943; Roth, 1915). In contrast, the Urubu Ka'apor from Brazil believe that the non-indigenous people were those created from its wood, while themselves were carved from *Handroanthus serratifolius* (Vahl) S.O. Grose (Balée, 1994). One of the formative clans of the Wayãpi from French Guiana, the *kumakapisuke* ("old beetle larva of the *Ceiba* tree") are the offspring of an incestuous couple, itself born of insect larvae found in the trunk of a rotting *Ceiba* (Grenand, 1989). The classic period Maya of Mesoamerica and their modern descendants give this tree a central place in their mythology (Freidel et al., 1993; Schele and

Freidel, 1990). Indeed, *yakché* (the green tree) is the primordial tree, the *axis mundi* of the Mayan world, passing through the seven heavens above the earth, and allowing the spirits of the dead to pass from one world to the next to finally reach the eternal abode (Tozzer, 1907). As exemplified by Cano & Hellmuth (2008), Guatemalan murals and ceramics from the classic Mayan period widely figure *Ceiba* trees and details, and pre-Columbian Mayan incense burners were particularly often represented with *Ceiba* prickles, probably associating this species to religious/spiritual aspects (Zidar and Elisens, 2009). The Hatx Winik, Lacandons from Chiapas, also see *Ceiba* as the pillar of the world, the support of the vault of heaven, and the dwelling place of the tree spirits (Pérez, 2005).

While in the Chamacoco's view of the universe, *Ceiba insignis* (Kunth) P.E. Gibbs & Semir (known in Paraguay as *pallo borracho*) is a cosmic tree, linking the earth and the sky (Sequera and Gangui, 2011), Levi-Strauss highlighted in the second volume of his mythological masterpieces that the *yuchan* of the Matako and Chulupies from the Paraguayan and Argentinean Chaco "once contained all the water of the world in its bulging trunk and where men obtained fish from one end of the year to the other" (Lévi-Strauss, 2009 : 86). Their Chorote neighbors also believe that all the water in the world and all the fish come from the trunk of the *Ceiba chodatii* (Hassl.) Ravenna (Scarpa, 2007). Among the Peruvian Yagua, the *lupuna* (possibly *C. lupuna*), is the water tree and the symbol of the axis of the world (Chaumeil, 2000). A Yagua myth tells how this giant tree was cut down by the two mythical heroes and, as it fell, created the Amazon (the artery of the world whose meanders correspond to the sinuous contours of the trunk and branches), all of its water emptying to form this great river (Chaumeil, 2000). Other versions of this myth are found in Amazonia, and Gomez Gruber (1997) reports that among the Tikuna, in the beginning only night existed because a large *Ceiba* obstructed the world and prevented light from entering

117 it. The primordial brothers tried to remove it without success. They called for help from all
118 the animals in the forest, but only a small squirrel succeeded in felling the tree, so that light
119 could finally appear. The trunk formed the Rio Solimões and its branches the other rivers and
120 creeks. To prevent the tree from growing back, the brothers put a giant turtle on the stump
121 to graze on the new shoots. A butterfly took the heart of the tree, which was still beating,
122 and gave it to an agouti which buried it. From the heart grew an *umari* tree (*Poraqueiba*
123 *sericea* Tul. or *P. paraensis* Ducke), which gave birth to the first woman, who married one of
124 the two brothers. Relation to water is also evident for the Kali'na of the Guiana shield, where
125 the mythical anaconda *alamari*, while lying in the canopy of a *Ceiba*, was so heavy that it
126 broke the branches under it and fell into the river and became the water spirit *Okoyumo*
127 (Ahlbrinck, 1931). For the Huaorani from Ecuador, the *Ceiba* is the primordial tree providing
128 shade, food and shelter, where all the beings dwelled in the beginning. This tree was bound
129 with a large vine, but a little squirrel cut it, so that the "*Amazon Basin was born from the*
130 *fallen giant tree, and the many species of fish from its leaves*" (Rival, 1999 : 361). Among the
131 Kogi from Colombia: "*When the ninth world, the highest world, was being formed, an*
132 *immense ceiba tree began to emerge from the pristine sea and around this cosmic axis the*
133 *four divine brothers built the first temple and called it alnúua. The ceiba tree is called ululá or*
134 *is personified by the name of the mythical Máma Zinkala. It was the first tree of Creation. (...)*
135 *A vertical line passing through the tip of the roof, through the centre of the floor and the*
136 *nadir which - in this case - is the apex of the invisible inverse roof, constitutes the cosmic axis,*
137 *identified with the spindle rod, with the great ceiba of Creation, or with the central pole that*
138 *the Mother placed in the centre of the snow-capped mountains.*" (Reichel-Dolmatoff, 1975 :
139 204). The Baniwa of Uaupes share this worldview of a giant *Ceiba* passing through the
140 different worlds stacked on top of each other, inhabited by different beings (Wright, 2020).

141 Lévi-Strauss (2009) points out that the Mocovi and the Bororo believe the milky way to be
142 the ashes of the tree of the world after it was burned down. This is similar to the Wayana
143 cosmovision: their founding demiurge, Kuyuli, and his companion burned a gigantic *Ceiba*
144 whose ashes became the milky way, which means in Wayana "*the place where the Ceiba was*
145 *burned*" (Chapuis and Rivière, 2003: 171). Wayana shamans travel the milky way during
146 trance (de Goeje, 1943).

147 Many Amazonian cultures consider this tree to be the vehicle for shamans to move through
148 the different strata of the world. Thus, as do the Baniwa, the Wayãpi of French Guiana
149 consider *Ceiba* to be the shaman's ladder used to climb and meet their spirit allies (Grenand
150 et al., 2004). Indeed, for them, this tree is inhabited by a *kumakaya*, a very powerful jaguar
151 spirit that only the most powerful shamans can domesticate (Grenand, 1980). The spirits or
152 metahumans, to use the term proposed by Sahlins (2019) with regard to Descola's animist
153 ontological scheme (2005), or the mother of this tree, are powerful and linked to the
154 masters of the forest. Among the Kali'na, dwelling from French Guiana to Venezuela, the
155 *Ceiba* is considered the *wewe yumu*, the father, or master of the trees (de Goeje, 1943).
156 Among the five types of shamans, which are defined according to the plant guiding their
157 initiation, there are *takini* (*Brosimum acutifolium* Huber), *chile* (*Capsicum annuum* L.),
158 tobacco (*Nicotiana tabacum* L.), *kwasini* (*Ficus* spp.), and *kumaka* shamans (using *C.*
159 *pentandra*). The spirits inhabiting *kumaka*, like those of the *kwasini*, were both beneficial
160 and maleficent, unlike the first three, which were only beneficial. Moreover, according to
161 (Gillin, 1936) the *Ceiba* tree is distinguished from other trees by the fact that it harbors many
162 spirits, including a particular being that lives only in this tree, the *kumaka akiri*. The number
163 of spirits hosted by it is also the reason for its gigantic size, and implies that it must not be
164 felled. If someone tries to fell it, the axe will inevitably break. And if in the end they finally

165 manage to cut the tree, the spirits that would escape from it will never be appeased.

166 Ahlbrinck (1931) tells a Kali'na myth about how a nine year old boy was attracted by the
167 spirit of the *kumaka* and was initiated. He became a very powerful shaman who was only
168 called for when a person died: he could resurrect them, while other shamans were
169 powerless. The boy used to sleep in this tree, and came back to the people only when
170 someone had died.

171 *Ceiba* is also considered a link with other spirit plants; for the Kali'na, the anaconda *alamari*,
172 who lived at the top of a *Ceiba*, was so gigantic that it completely covered the branches of
173 this giant tree. It hunted without leaving its tree, attracting game with its spells. One day, a
174 young girl collected some white clay at the foot of the *Ceiba* and smeared it on her garters to
175 whiten them. But it was *alamari's* excrement, so he became her husband. The villagers
176 opposed this union, set a trap for *alamari*, and burned him alive. From his ashes grew the
177 charms *tulala* (*Caladium* spp.) (Ahlbrinck, 1931). *Alamari* is considered the spirit of this tree
178 (and that of the *takini*) and controls all *Ceiba* and other trees' spirits (de Goeje, 1943). The
179 Teko from French Guiana similarly consider that if the remains of a giant otter, *tsololo*
180 (*Pteronura brasiliensis*), are buried at the foot of a *kubaka* (*C. pentandra*), all sorts of
181 medicinal plants will grow on its rotting body (Navet, 2008). They tell that "*in the kubaka,*
182 *there can be good and bad spirits. When the tree is beautiful and clean underneath, it means*
183 *that there are kaluwat (good spirits) but when the tree is not beautiful and is dirty*
184 *underneath, it means that it is inhabited by baskilili and gulupi (bad spirits)*".

185 For the Tikuna, the master of this tree is the master of the forest or curupira, *ngo'o* in Tikuna
186 (Matarezio Filho, 2015). The spirit of the *Ceiba* is considered to have a black color among the
187 Yagua, Kali'na and Teko. The Palikur from French Guiana and Brazil use a bath of *Ceiba* bark

188 during the initiation of shamans (F. Renoux, pers. comm.). Similarly, the Yagua make a
189 shamanic initiation cigar from its bark (Chaumeil, 2000). For the *curanderos* from
190 Huancabamba (Peru), *Coleus* sp. mixed with *C. pentandra*, *higiron* (an unidentified species,
191 probably a *Ficus* sp.), latex of *lechero* (*Euphorbia* sp.), chili pepper (*Capsicum annuum*), salt,
192 alcohol and holy water can kill an enemy (De Feo, 1992), while the Peruvians of Loreto
193 consider its bark a shamanic poison (Roumy et al., 2020). Among the Yanomami, the spirit of
194 the *Ceiba* is invoked during shamanic treatments to scare away evil spirits and evil
195 substances are dispersed via its cottony fibers (Albert and Miliken, 2009). Bennett et al.
196 (2002) describes an Aguaruna myth: "A person clears the plants from the base of a *Mente*
197 tree (*Bombacaeae* spp.) and then drinks green tobacco juice until he becomes intoxicated.
198 During a storm the "wiakuch" or soul of the tree comes. "Wiakuch" gives the person magical
199 darts that enable him to become a shaman". Ese-Eja from Peru consider it a "teacher plant"
200 in ayahuasca shamanism and "sorcery with *Ceiba* spp. causes the swelling of the victim, a
201 condition which on one case was medically diagnosed by hospital workers as water retention
202 through kidney malfunction" (Alexiades, 1999).

203 The Shipibo also attribute a very powerful spirit to *Ceiba*, which is associated with ayahuasca
204 and brings visions (Saavedra, 2006). When a Shipibo wants to become a shaman and wishes
205 to know the spirit of this tree, he drinks the bark with tobacco in the morning for six to eight
206 months (Childs, 2012). Among the Chorote of Argentina and Paraguay, a shamanic chant
207 linked to the *Ceiba* tree allows one to meet the drinking water accumulated inside its trunk,
208 and songs also allow the shaman to use the trunk as a "jail of souls" (Scarpa, 2007). Among
209 the Amazonian Mestizo populations of Peru, the spirit of this tree is considered very
210 dangerous and acts as a sorcerer and can kill people who do not follow the required
211 recommendations (Luna, 1986). This author states that among the Shipibo of Peru, the spirit

of this tree is the supreme spirit or chief of the forest and of the spirits of the other trees, and also the chief spirit of the Shipibo shaman (Saavedra, 2006). It is considered to be the rain tree, and rituals are held near it to beg for rain, further reinforcing the link between *Ceiba* and water. Among the Shipibo and Conibo, Tournon (1990) says that the *Ceiba* can 'cutipar' and if a father cuts it down, his son will be bewitched and suffer from a swelling of the belly. The remedy consists of bathing in a decoction of bark from the same tree. Among the Tacana of Bolivia, *Ceiba's* spirits can cause "mal viento" (DeWalt et al., 1999). The Sumu Ulwa of Honduras also believe that a powerful spirit inhabits this tree (Coe and Anderson, 1999). The Shawi in the Peruvian Amazon fear this tree because of the spirits it hosts. They are said to turn around its canopy at night, whistling, and it is advised not to stay nearby. Among the Yagua of Peru, the mother of the *Ceiba* is very powerful, and the shamans use it to deprive victims of their vital principles and drive them mad by subtracting their spirit and causing their stomach to swell. This mother of the *Ceiba* has either the form of a snake (like the Kali'na), an earthworm or a human form, and its color is black (Chaumeil, 2000). Moreover, the ability of this tree to move is regularly mentioned in the literature. The Arawak of Guyana believe that it moves nightly and returns to its place afterwards, this ability being due to the spirit that inhabits it (Roth, 1915). For Dance (1881), the guardian spirit of this tree 'walks around the tree at mid-day and at mid-night'. According to the Yaminawa, the *Ceiba* is the house of *Xuba*, a strong and aggressive being that can cause illness to whoever passes by or whoever tries to cut it down without taking the proper precautions, and is especially harmful to parents with newborn children, as the spirit of the tree can borrow the soul of the child (Gil, 2014). Among the Miskito, dwelling from Honduras to Nicaragua, the *Ceiba* spirit called "Sisin dawanka can offer individuals wealth, success with members of the opposite sex, misfortune for their enemies, and so on: the supplicant has only

236 to approach a *ceiba* tree where the *dawanka* is supposed to live and a door will open in the
237 tree to admit him or her. At that moment the deal begins. The *dawanka* may grant the
238 suppliant a major request but usually asks for payment. For example, he or she may grant
239 the suppliant his or her wish with the understanding that he or she will later claim his or her
240 first child, an aspect of the contract that the human participant, in his or her greed, may not
241 take into account. Later, the *dawanka* may return to claim what he or she considers to be his
242 or hers by right of the contract.” (Jamieson, 1970). For the Colombian Siona, it is the most
243 dangerous tree. It has three different classes of *huati* (invisible spirits): those which live
244 under the roots and scare people by giving them diseases, those of the trunk, which are
245 located in the buttresses and sometimes appear to hunters to make them get lost, and those
246 in the foliage, the *huati*, whose long tongues hangs down to catch men passing underneath.
247 If caught, the person will suffer from a disease that causes the tongue to hang out of the
248 mouth. It is therefore not advisable to pass alone under a *Ceiba*, and if you must, you should
249 whistle and smoke a cigarette to protect yourself (Langdon, 2014), and the Kalinago from La
250 Dominique consider that *Ceiba* shelters spirits which might become angered if disturbed
251 (Hodge and Taylor, 1957).

252 Along with being considered a shaman's spirit ally, the *Ceiba* is connected to death, and is
253 sometimes perceived as a psychopomp tree. The Chacobo consider that the souls of the
254 dead reside in the trunk of the *Ceiba* (Erikson, 2014). Among the Maya (Landa), the souls of
255 the dead go to the great green tree (*yakché*) in order to enjoy the coolness of the shady
256 branches, under which they enjoy eternal rest (de Goeje, 1943). The Wayana, living in Brazil,
257 French Guiana and Suriname, consider that after death the soul reaches a gigantic tree, and
258 among the Trios and Guarayos this tree is none other than the *Ceiba* (de Goeje, 1943).

A symbolic species among Afro-descendants

Interestingly, *C. pentandra* is also omnipresent in the Afro-American magico-religious universe (Nossin, 2019). As Hurbon (1972) pointed out, the strong permanence in Haitian voodoo of the attribution of magical properties to the silk cotton tree is undoubtedly the result of a resonance between beliefs of African origin (the tree is sacred in many West African cultures: Burkill, 1995) and the cultural importance of this same species within many indigenous American cultures (see previous parts). The convergence of these analogous belief systems must have contributed not only to the reinforcement of those of the enslaved Africans and their descendants, but also, through an interculturalization effect (Tareau, 2019), has given rise to reinvented practices that do not appear to be the simple survival of African rituals (Price and Mintz, 2013).

In Cuba, *C. pentandra* is also a major host tree for several *orishas* (including *Aggayù*, *Babà*, *Iroko*, *Obatalà*, *Oddùà*, *Ogùn*, *Oko*, *Olofi*, *Shangó*, *Yemayà*) and is therefore the object of a particularly important devotion among a large part of the population following Afro-Cuban cults. According to a widespread syncretic belief in Cuba, and providing an interesting Christian explanation to the popular sacralization of the tree, the Virgin Mary and the infant Jesus took refuge in a cavity of a silk cotton tree, which closed and grew thorns to protect them (Pesoutova et al., 2019). According to Cabrera: "*the dead, the ancestors, the African "saints" of all the African nations that came to Cuba and the Catholic saints go to this tree and inhabit it permanently*" (Cabrera, 2003 ; p. 166). The tree, which in Cuba is also never cut down, is called *iroko* by the Afro-Cubans, in memory of the tree revered throughout the Guinea coast, *Milicia excelsa* (Welw.) C.C. Berg, called *iroko* in western Africa (Quiroz, 2015; Quiroz and van Andel, 2018). In addition, in the mythological representations of Afro-Cuban

282 Santeria, *Iroko* is also the name given to an important *orisha* who is believed to live in the
 283 trunk of the *Ceiba* tree in the company of his wife *Aboman* (Cabrera, 2003).
 284 Called *mapou* or *pye mapou* (probably an apocope of the common kongo name *mapouata*;
 285 (Nossin, 2019, citing Durand and Logossah, 2011), in Haitian Creole, it is arguably the most
 286 revered plant species in Haitian voodoo (Hurbon, 1972). Indeed, this tree serves as the
 287 residence (in Haitian Creole: *repozwa* or *kay lwa*) of several spirits (*lwa*) of the Haitian
 288 voodoo pantheon, particularly those of the Gede (Tarter, 2015), who are the *lwa* of death
 289 (Marcelin and Métraux, 1947). According to several testimonies collected from Haitian
 290 voodooists, it is also home to the *lwa Agarou*, god of the wind and the storm, *Loko* (probably
 291 by borrowing another vernacular name of the species *M. excelsa*, *loko* in fon), god of trees
 292 and forest, and *Erzili*, the goddess of fertility (Marcelin and Métraux, 1947). For this reason,
 293 it regularly receives offerings and libations, and scarves, candles and images in the symbolic
 294 colors of the *lwa* associated with it are regularly attached to its branches or trunk (Picture 2).
 295 Luck baths (*ben chans*) are commonly taken near the tree by practitioners who hope to
 296 attract the favor of the spirits it shelters. In addition, its status as a sacred tree means that it
 297 is almost never cut down, for fear of divine reprisals that could fall on those who commit this
 298 act, unanimously considered as sacrilege (Séverin, 2002): "*Mapou is the cathedral of voodoo.*
 299 *The Catholics put candles in the chapels, we put ours on its trunk. So cutting down a mapou*
 300 *tree, for a voodooist, is like destroying a church for a Christian. It is a serious sin*", Haitian
 301 man residing in Cayenne, French Guiana.
 302 Among the Aluku Maroons of French Guiana, the seedling is used to strengthen babies
 303 (Fleury, 1991). The spirits related to the supreme god *Papa Gadu* (or *Voodun*) as well as
 304 *Ampuku*, the spirit of the forest, reside in this tree called *kankantii* (by deformation of the

English “cotton tree”) and may be incarnated in the red-tailed boa (*Boa constrictor*, called *daguwe*, from the Dahomean *dāgbe*, an Ewe-Fon word also used to designate a sacred snake: Herskovits and Herskovits, 1936). However, unlike the Caribbean and French Guianese Creoles who do not hesitate to plant it (some silk cotton trees are even enchanted - *monté* in French Caribbean Creole) to protect a plot of land against evil spirits and promote their owner's luck (Benoît, 2000; Vilayleck, 2002), the species is avoided around the homes of the Maroons. Although, paradoxically, several Maroon villages are characterized by a giant silk cotton tree overhanging and “protecting” them, French Guianese Maroons consider that it can carry evil entities. Thus, we can probably argue - to use the image formulated by Price and Mintz (2013) – that the same symbolic container (the sacralization of *C. pentandra*) has spread within several Afro-descendant cultural groups, but that their particular histories have forged different contents (the beneficial or maleficent “nature” of this species). In any case, as early as 1890, the explorer-missionary Verschuur reported the *kankantii* tree as the most venerated tree of the Maroons of French Guiana (Verschuur, 1894) and contemporary testimonies confirm this idea: “*The kankantii is like a lightning rod, it attracts evil spirits. It shelters both the good and the bad ones. [...] The ampuku spirit lives in the big kankantii, that's why we don't cut it down or burn it. We put beers at its foot for them. It is also where we make music for the obia [spirits]. People also bathe under the kankantii for good luck, but if you use its leaves or bark to make remedies, you have to pay him with beer and rum. If someone is possessed, they are bathed under the kankantii so that the ampuku spirit in the person returns home*”, Saamaka man living in Matoury, French Guiana.

Some healing houses are nevertheless located at the foot of large silk cotton trees in order to allow the medico-magical rituals to be more effective thanks to the nearby deities present in the tree (Picture 3).

In the other Creole societies of the Caribbean and the Guiana shield, where Afro-descendant religious heritage is less institutionalized than in the previous cases, some survivals must nevertheless draw our attention to the persistence of a certain religiosity around *C.*

pentandra. This tree is a dwelling place for African spirits in Venezuela (Pollak-Eltz, 1972). In Martinique (Nossin, 2019; Vilayleck, 2002), Guadeloupe (Benoît, 2000), French Guiana (Ribal-Rilos, 2004), Suriname (van Andel, 2010; van Andel and Ruysschaert, 2014) and in the Dominican Republic (Pesoutova et al., 2019), it would not occur to an inhabitant to cut down this tree, which allows it to survive in the urban space where it sometimes remains isolated amongst buildings (Picture 4).

In the same way, many people continue to venerate the tree in a clandestine way, talking to it to ask for advice or courage, or lighting a candle at its foot in honor of the deceased or in search of luck. The Martinican poet Césaire himself regularly visited a silk cotton tree, the only tree to survive Mount Pelée's eruption in 1902 (Nossin, 2019). This devotion is however mixed with fear, since *C. pentandra* is considered "*the devil's tree par excellence*", housing potentially dangerous spirits such as *soukoyans* or *soukliyan* (flying entities that, like vampires, suck the blood of their victims) in the French West Indies (Leti, 2000) or the *jumbies/duppies* in Jamaica (Corzani, 1994; Keegan and Carlson, 2008).

If it is true that these magical attributes are sometimes transversal to the shamanistic properties mentioned above within many Amerindian communities, they are also linked to uses found in Africa. Indeed, Burkill notes that it is the most important fetish tree in many

West African cultures and that, for example, in the Sudanian region it is considered to be inhabited by the divine python (Burkill, 1995). Herskovits also notes that in the former Dahomey the silk-cotton trees are revered because the souls of ancestors have taken their residence in them, likewise among the Ndjuka from Suriname (Herskovits and Herskovits, 1936).

Medicinal uses

Alongside the properties of *Ceiba* in shamanistic healing, some phytotherapeutical uses, although much less numerous, can also be noted throughout its distribution. Among these, the most common are as a diuretic, analgesic or for healing wounds.

The species is used for waist pains and as a diuretic among the Pilaga of Chaco (Filipov, 1994). Among the Ayoreo, from Chaco as well, the plant is employed to cure open wounds (Renshaw, 2006). Some observation of its use against leishmanial external lesions were made among the Wayãpi (Odonne et al., 2011) and the Ashuar (Giovannini, 2015) who apply the ground bark directly. This last application is also noted among the Kallawaya in the treatment of tetanic wounds (Girault, 1984).

Among the latter community, the decoction of the flowers is applied to the temples and forehead against headaches (Girault, 1984). Similarly, the infusion of flowers is drunk to relieve headaches in Venezuela (Delascio-Chitty, 1985) and, in Guadeloupe, when a child is teething, he is given a mouthwash with a decoction of *Ceiba* leaves mixed with soursop leaves (*Annona muricata* L.) and *Bidens* sp. leaves (Bougerol, 1993). In Martinique, ground fresh leaves are used in capillary massages for baldness, and the root bark is drunk as a depurative decoction (Ouensanga, 1983). Among the Amazonian *ribeirinhos*, the sap is a remedy against conjunctivitis and the bark is used as an antidiarrheal and diuretic (Silva et al.

1977). Finally, in the Saint Lucian community of French Guiana, the ground bark of the trunk is used in the composition of a plaster used to heal broken limbs (Tareau, 2019).

The astringent mucilage contained in the bark is also used in other parts of the world. For example, a bark decoction is used as mouthwash in Senegal and Liberia, and for febrifuge in Nigeria (Burkill, 1995).

Technical uses

One of the best known technical uses of *C. pentandra* in Amazonia is the use of its cottony stuffing or kapok - a term derived via the Dutch from the Malay *kapuq*, which refers to the fibers surrounding the seeds (Couplan, 2000). Indeed, among all Amazonian peoples using blowpipes for hunting or warfare, these cottony fibers are used as a stuffing attached to blowgun darts to form a pressure seal and airfoil. This use was observed among many cultural groups: Siona (Vickers and Plowman, 1984), Matis (Erikson, 1996), Huaorani (Davis and Yost, 1983), Shuar (Bennett et al., 2002), Yagua (Chaumeil, 2000), Nikak (Mahecha and Franky, 2013), etc. Etymologically, this use can be identified in the shuar word for *Ceiba*, *wampuish*, from *wampúch* « little weight » (Bennett et al., 2002), in siona, *huo yui* “blowgun cotton” (Vickers and Plowman, 1984) and in english, silk cotton tree. Siona people used the seed as a fish bait (Vickers and Plowman, 1984). Kapok was used industrially until after the Second World War because it is considered to be high quality, insulating and moisture resistant (Pio Correa, 1984; Zeven, 1969). Kapok has since been dethroned by synthetic fibres, with the world's leading producers remaining Indonesia and Thailand, which produced almost all of the world's kapok with 101,300 tonnes in 2013¹. Before the second

¹ <https://knoema.com/data/agriculture-indicators-production+kapok>

394 world war, the kapok tree was an important commercial crop, because its fibers were used
395 extensively in life-jackets and life-belts, in clothing for aviation, as a mattress and cushion-
396 filling material and in noise insulation for aircraft (Zeven, 1969). In Brazil, as in Guyana and
397 Mexico, kapok was used for pillows and mattresses (Cano and Hellmuth, 2008; Silva et al.,
398 1977; van Andel, 2000).

399 Another important and nearly universal use is that of its wood, which is particularly soft and
400 light. Before the spread of mechanical tools, this wood was widely used to make large
401 canoes (in former Dahomey, this tree was known as “the tree of the canoes”: Burkill, 1995).
402 Pre-Columbian peoples, in the absence of iron tools until 1492, preferred easy to carve wood
403 for their dugout canoes, and it is sometimes asserted that the West Indies were settled from
404 Venezuela using *Ceiba* canoes (Bernand, 2019). This use is found among the Taino and the
405 Caribs from Martinique (Breton, 1665), but also among contemporary Jamaicans, the
406 Tsimane (Reyes-García, 2001), the Payas of Honduras (Lentz, 1993) and the Maya of Yucatan
407 (Cano and Hellmuth, 2008). The Warao used this tree to make canoes that could carry up to
408 80 people (Roth, 1915). One of their myths, the story of Haburi (their civilizing hero), tells
409 how he built a canoe out of wax, then out of clay, then out of different kinds of wood, but all
410 these canoes were stolen by ducks, and only the one made out of *Ceiba* was not stolen
411 (Roth, 1915). Puerto Rico even made the *Ceiba* its national tree in memory of the
412 importance it had for digging canoes (Shearn, 2020). Some groups such as the Yanomami
413 made containers for their plantain puree (an important preparation in death ceremonies:
414 the use of *C. pentandra* may not be coincidental) (Albert and Miliken, 2009) and among the
415 Piaroa, these canoes were used for cassava beer in Jurupari ceremonies (Mansutti
416 Rodríguez, 2019). The Shuar also used the buttresses of the *Ceiba* to make shields (Bennett
417 et al., 2002). In an original way, the Wayana use its buttresses to carve their wheel-of-the-

418 ceiling, or *maluwana*, a painted wooden circle which is attached at the top of their round
419 collective house, the *tukushipan*. This *maluwana*, decorated around its perimeter with
420 triangles representing the thorns of the trunk of *C. pentandra*, is painted black and
421 numerous monstrous and metamorphic aquatic beings, the *ïpo*, are drawn on it (Duin, 2009).
422 This object is culturally important because it protects the building in which it is placed.
423 Nowadays these *maluwana*, which are still used in *tukushipan*, are the object of a growing
424 art trade and provide a living for several craftsmen.
425 Its wood, considered good for cellulose, was overexploited in Peru in the 1970s and 1980s to
426 make plywood: five factories were dedicated to it in the late 1970s (Gentry and Vasquez,
427 1988). Moreover, Descola (1996) mentions that the Ashuar have long sold *Ceiba* driftwood
428 logs to the Spanish.

429 What makes *Ceiba* magical?

430 In regards to Amazonian cultures, there is an obvious and direct relationship between kapok,
431 hunting darts and spiritually-propelled shamanic darts, allowing anthropologists to draw
432 attention to the agency of the fibers of this culturally significant tree (Chaumeil, 2000). The
433 sharp, spiny thorns on its lower trunk can be compared with shamanic darts and its size can
434 be correlated with the enormous power of its spirit. The inhabitants of the Lesser Antilles
435 consider that the silk cotton tree is the refuge of the *volan* or *soukouyans*, vampire-like flying
436 evil creatures, which would turn around its top during full moon nights (Leti, 2000). This
437 description is perhaps due to the numerous bats that contribute to the pollination process of
438 the species (Gribel et al., 1999; Lobo et al., 2005).
439 Several traits of the *Ceiba* are evoked within African American cultures to attest to the
440 magical nature of this tree. According to van Andel et al. (2013), in the emic representations

441 of the Ndjuka from Suriname and French Guiana, one of the proofs of its divine power is that
442 many animals and plants (epiphytes) find refuge on its branches. Moomou (2013 : 422)
443 notes that "*the kankantii is also feared because of its gigantism. Indeed, it is the largest tree*
444 *in the forest, which [...] is necessarily home to deities*". This last point is also stressed by
445 Tarter (2015) in Haiti, where the physical enormity of this species, as well as its immutability,
446 are singularities often designated to explain its magical character. Moreover, its capacity to
447 remain immutable through time would also explain its resistance to climatic hazards
448 (hurricanes, lightning), which according to Cabrera (2003), is regularly mentioned by Afro-
449 Cubans to justify the mystical properties commonly attributed to it. Furthermore, as in many
450 indigenous cultures, it appears that several Afro-descendant communities consider the silk
451 cotton tree as a sort of mediating antenna between humans and the gods (Small and Small,
452 2003).

453 Métraux notes that in Haiti the large *mapou* move at night to visit each other and terrorize
454 travelers on the roads, with their branches like long arms (Marcelin and Métraux, 1947 ; p.
455 144), a belief also related from Jamaica in the 19th century (Rashford, 1985). This point
456 highlights one of the characteristics of the notion of *tree agency* developed by Jones and
457 Cloke (2008), namely the fact of recognizing in them anthropomorphic qualities.

458 Finally, one of the most common biocultural justifications for the magical power widely
459 devoted to this plant species in African-American societies is the regular presence of springs
460 or streams where it grows (Séverin, 2002). Indeed, generally preferring alluvial soils (Small
461 and Small, 2003), *C. pentandra* is often accompanied by this vital and fundamentally
462 determining element in the cultural designation of plants considered magical (Nossin, 2019;
463 van Andel et al., 2013). Moreover, the medico-magical therapy of Haitian voodoo

recommends taking protective plant baths in the streams that flow near the *mapou* (Tareau, 2019).

As Roe wrote, « *It is an “anomalous” tree because its trunk is bulbous, rather than straight, and hollow rather than solid. Moreover, it is soft, rather than hard, and light in weight, rather than heavy, the normal characteristics of trees. It is also significant that it bears water in its interior. The whole tree is like some sort of curious fruit with its aqueous interior and bulbous shape* » (Roe, 1982: 141).

Defining “Spiritual Keystone Species”

The widespread significance of *C. pentandra* among Amazonian, Caribbean and West African peoples, and the strong correlations and overlaps in beliefs and practices connected to it (sheltering spirits, shamanic potency, mythic snake, origin of the waters, creation) can be understood as an expression of the World Tree or *axis mundi* concept as expressed by Eliade (1958). The tree at the center of the world, which connects the upper and lower realms and defines the vertical dimension of space with its trunk and the horizontal dimension with its roots and branches, is a foundational concept for many cultures, and has been associated with a wide range of different tree species. The process by which the symbolic world tree is identified with a Linnean species is naturally dynamic, as it is subject to processes of cultural exchange, transformation and hybridization. For example Yggdrasil, the world tree of the Norse, is generally identified as an ash tree (*Fraxinus excelsior* L.), but sometimes also with the yew (*Taxus baccata* L.) (Hooke, 2012). The dynamic nature of the process of sacralization of specific trees is particularly notable with *Ceiba pentandra*, in part because of the application of the common name ceiba to the related *Bombax ceiba* L., which is also a sacred species in its natural range in Asia (Fowler, 2003; Jain et al., 2009). This appears to have

487 facilitated the sacralization of *C. pentandra* in areas where the two species both occur, for
488 instance in India (Chauhan and Chauhan, 2019), through a process of cultural hybridization
489 similar to that which has taken place in Amazonia and the Caribbean.

490 The physical and mythological centrality of species like *C. pentandra* and *B. ceiba* make them
491 perfect candidates for Cultural Keystone Species, as defined by Garibaldi and Turner
492 according to a set of six core criteria (Garibaldi and Turner, 2004). *Ceiba* trees meet four of
493 these criteria remarkably well (intensity and multiplicity of use; linguistic evidence; role in
494 rituals; persistence in cultural memory), so it is not surprising that *C. pentandra* is sometimes
495 identified as flagship species (Anderson, 1997; Bowen-Jones and Entwistle, 2002). However,
496 *Ceiba* trees do not match well with the criteria of 'unique position within a
497 culture/irreplaceability' because of the fluidity of belief and practice in relation to the
498 different *Ceiba* species. They also do not play a central economic role in most cultures to
499 which they are important, so the degree to which they 'contribute to resource acquisition' is
500 minimal or at least irregular.

501 The concept of Cultural Keystone Species was originally an adaptation (Platten and Henfrey,
502 2009) of the 'keystone species' concept of ecology (Paine, 1969). It has been applied to a
503 diverse range of culturally-important flora and fauna, from rice in the Phillipines (Zapico et
504 al., 2020) to bears in Canada (Clark et al., 2021), echidnas in Australia (McKemey et al.,
505 2019), medicinal plants in French Guiana (Tareau et al., 2020) and herring on the Pacific
506 coast of North America (Moss, 2016). Modifications of the original concept have included
507 combining it with the concept of biocultural diversity, arguing that 'Biocultural Keystone
508 Species' better captures the diverse range of ecological and cultural significance such species
509 often hold (Shackleton et al., 2018). It has also been expanded to things beyond the level of

510 'species', such as Cultural Keystone Places (Cuerrier et al., 2015) and Cultural Keystone Food
511 Groups (Taylor and Anderson, 2020). Recent critiques of the concept have pointed out that
512 until now it has been applied in a largely qualitative fashion, and little has been done to
513 further revise the metrics originally proposed in Garibaldi and Turner (2004) (Coe and
514 Gaoue, 2020a, 2020b).

515 In light of the continuing utility of the Cultural Keystone Species concept, we propose a
516 refinement of the term which better captures the cultural centrality of *C. pentandra* and
517 related species: *Spiritual Keystone Species*. As their essential nature is immaterial, spiritual
518 keystones do not need to aid in resource acquisition, so this criterion is discarded. Given the
519 exchanges and correlations of practices between different cultures around different
520 Bombacoideae species, the criteria of irreplaceability is also discarded. Indeed, *C. pentandra*
521 is one (the pre-eminent, but still only one) of numerous species that can host different kinds
522 of spirits in many Neotropical ontologies; the mutability of identity of the 'Ceiba tree' is
523 related to the fact that the spirits inhabiting it can themselves inhabit other trees or beings.
524 It is possible that Spiritual Keystone Species, as opposed to Cultural Keystone Species, are
525 actually more likely to morph over time, as the same unit of cultural meaning becomes
526 applied to different species that share the same spiritual qualities. Instead of the criteria of
527 irreplaceability and resource acquisition, we propose the adoption of two new criteria: 5)
528 the presence of culturally-derived beliefs, rules, or taboos that regulate contact with the
529 species; and 6) the attribution of magical efficacy or the ability to mediate between humans
530 and spirits, deities or divine realms.

531 The Bombacoideae trees are an excellent example of Spiritual Keystone Species given their
532 widespread centrality in spiritual practices and the presence of numerous taboos against

cutting or injuring them. Another classic example of a Spiritual Keystone Species is *Ficus religiosa* L. (and related species), which is similarly protected by taboos against cutting it down, and is sacred to Buddhists as the Bodhi Tree under which Buddha attained enlightenment and to Hindus as a manifestation of Vishnu (Jain and Kapoor, 2007). The baobabs in Africa (*Adansonia* spp.) (Marie et al., 2009), the ash (Dumont, 1992) and the yew in Europe (Hageneder, 2015; Hooke, 2012) and *Araucaria* spp. in Chile (Herrmann, 2006) are further examples of Spiritual Keystone Trees, while the jaguar (*Panthera onca*) in Amazonia (Shepard, 2014), Asian elephant (*Elephas maximus*) in south and southeast Asia (Ramanathapillai, 2009) and reindeer (*Rangifer tarandus*) in Siberia (Vitebsky and Alekseyev, 2015) could be considered examples of spiritual keystone animals.

It is important to note that although there are often many 'sacred species' (Pungetti, 2012) which likely fulfill some of the criteria laid out here, only a few of these species generally meet all the criteria and thus constitute true spiritual keystones. There are also important differences with 'sacred trees' and 'sacred groves', because individual trees are sometimes considered sacred while the species to which they belong is not. Perhaps the most striking difference between the spiritual keystone approach and other conceptions of keystone species is that the sacred *species* is in fact an ethnospecies, and the mutability of its application to different Linnean species is a significant indicator of its immaterial cultural function. An excellent example of this mutability is the use of both silver sage (*Salvia argentea* L.) and the botanically unrelated sagebrush (*Artemisia* spp.) as purifying plants falling under the same common conceptual category of 'sage', a potential Spiritual Keystone Species in parts of North America (Paldam, 2018).

Conclusion

Although much had been said in anthropological/ethnobiological monographs about *Ceiba* spp. in the Neotropics, a comprehensive review has been lacking. This review allows an understanding of the central place that *C. pentandra* and associated species share through most of the cosmovisions from the cultural groups present in their distribution range. *Axis mundi*, related with water and water spirits, psychopomp or associated to shamanistic practices: these aspects are all much related to the spiritual realm. If this can be explained by some particular traits, such as its incredible size, rapid growth, conspicuous thorns, seasonal defoliation pattern and bat pollination, the fact that this tree's perception is shared by so many cultures, both indigenous, Afro-descendant and West-African, is uncommon. Spiritual keystone species, as *C. pentandra* can be defined as, are likely to be culturally-specific, but this one stands as a common thread for almost all Neotropical and Caribbean cultures, making it probably the most emblematic species of its range. The concept of spiritual keystone species needs to be further explored and refined, notably through a worldwide review of what species fall within its definition.

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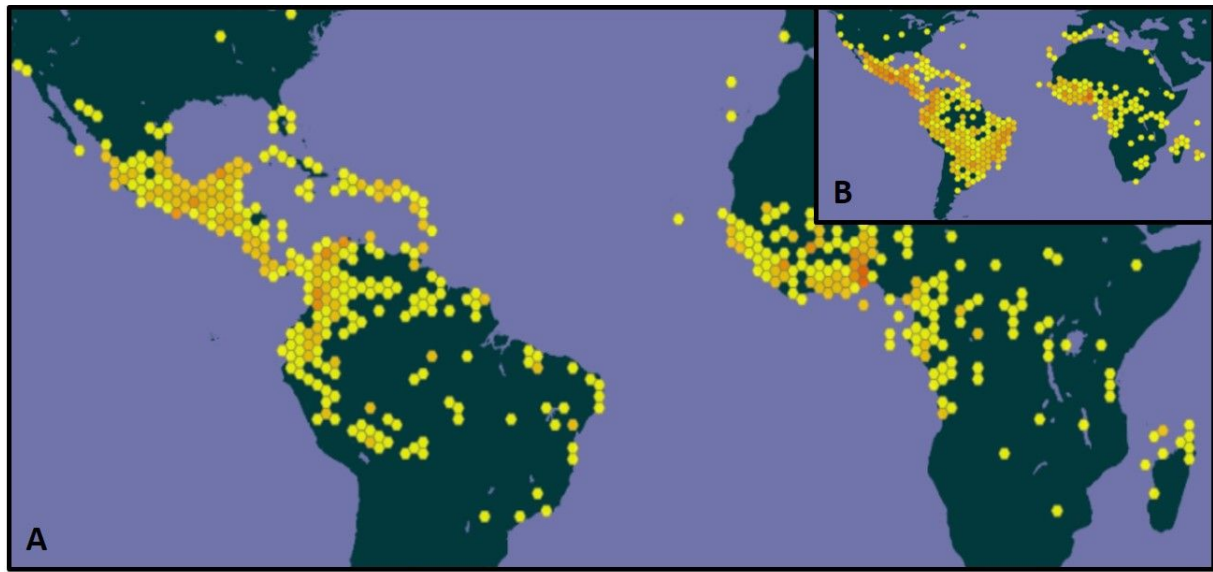


Figure 1: Distribution maps of the American and African range of *Ceiba pentandra* (A) and *Ceiba* genus (B), extracted from *Ceiba pentandra* (L.) Gaertn. in GBIF Secretariat (2021). GBIF Backbone Taxonomy. Checklist dataset <https://doi.org/10.15468/39omei> accessed via GBIF.org on 2021-07-31.



Picture 1: a *Ceiba pentandra* emerging from the morning fog along the Lawa River in French Guiana ©G. Odonne.



Picture 2: *C. pentandra* tree used for voodoo ceremonies in Cayenne, French Guiana. ©M-A Tareau.



Picture 3: A Ndjuka maroon healing house (Obia osu) under a *Ceiba pentandra* in 2004 close to the Maroni River. ©D. Davy.



Picture 4: A preserved silk cotton tree in Cayenne. M-A Tareau.