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Differentiated Content: An Expose on Ceiba Pentandra and Ficus Thonningii Species as Perceived in the Haitian Beliefs

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Abstract

Among the woody species found in Haiti, two are of primary importance: *Ceiba pentandra*, known in the region as mapou, and its counterpart, *Ficus thonningii* (or *Figuier maudit*). Both species are renowned in various places worldwide for their medicinal and pharmaceutical attributes. However, in Haiti, they are primarily associated with entrenched meanings related to the cultural beliefs and practices of native Haitians, who staunchly maintain the supernatural potentialities of these flora. Several researchers attest to their numerous healing benefits for the symptoms of many illnesses, but medical data have not been sufficiently compelling despite this pervasive belief system. Longitudinal inquiries could uncover a cultural motive for this fixation on unproven facts, at the risk of underestimating many other valuable attributes of the trees. In this study, general system theory was applied to analyze aspects of Haitian culture relative to individual beliefs about those species. The rationale of this phenomenon could be a case of communicative autopoiesis, whereby a system of operations creates a structure, thus establishing a network that continuously reproduces more operations within the system. Those traditional perceptions are trapped and buried, without the possibility of refinement or factual examination. The rigidity of those norms is so questionable that the presumption of a principle was essential. In the present study, it was assumed that those traditions derive from a series of *linguistic operations* that create a network wherein the process of *autopoiesis* occurs repeatedly in the *system* (L.O.A.S), as this network continues to replicate. The claim is that there is a method of communication that exists and maintains those trends. The assertion here is to cultivate an alternative to deep-rooted cultural views as much as to enlighten the locals with valuable knowledge and benefits regarding the flora under consideration.

Keywords: *Ceiba pentandra*, native Haitians, *autopoiesis*, Ceiba.

INTRODUCTION

Writer's experiences were the driving forces in the wake of this research about the Ceiba *pentandra* and the *Ficus thonningii*. The first one being a phylogeny of the family Malvacae and subfamily of Bombacoideae, Bombacaceae (Pezzini *et al*., 2020), this tree has multiple names. Formally known as *Ceiba pentandra*, and depending on the region, it is called the Silk cotton tree, Red silk-cotton, Red cotton tree, Kapok, Bombax, Fromager, Sacred Tree, Tree of Life, Money Tree, Mapou Rouge, and Bois de fléau (Ducoeurjoly 1802). In Haiti, one trembles with fear when hearing the name "Mapou." This tree made history when it was identified as the tree of liberty of Haiti. The revolution that ended slavery on the island was conceived following a community meeting held by enslaved people under a mapou tree located in "Bois Caiman," the north section of the country (VanHook, 2020). The old mapou tree outlived many people, and there are rumors that it still stood at the beginning of this century. Although there are questions as to whether this dramatic event ever took place, the giant tree is a symbol of freedom for native Haitians, among other associations.

The Ficus, of which there are some 800 species, is familiar to the locals. This wild fig (*Figuier maudit*) can also make people shiver when they hear its name. The epithet has a negative connotation: the French word *maudit* signifies "cursed," and thus implies the tree is a bad omen. Presumably, if the tree were originally called *Ficus carica* or *Ficus sur*, it would have caused less fear, and now be viewed more favorably by the locals. Unlike the mapou tree, the Ficus has no historical status in Haiti. Nevertheless, the trees share many associations, the main one being that the natives claim that they are the site of repository for the spirits. As I was growing up on the island, my

beliefs were partly formed by these assumptions along with my own experience.

Personal history with Ceiba was established with a tree that stood on the family's property at Grande Saline in the West Department. The tree was visible on the far left of the main entrance, near a well—a tree that resembled what Zeven (1969) has described as the "Lanang." Not too high, it had a canopy that curved down to the ground, blocking the view of its trunk and surface roots. It was impenetrable, with leaves too shaggy for access. If not for the fear, one could seek cover next to the unseen stem. This tree commanded attention— no one could miss it, for its presence seemed to loom over the property. Rumors from the locals who frequently visited the habitation were endless. There was no reason to approach the tree; thus, keeping a safe distance from it was the custom. A Ficus tree in that same locality could be found on the right side of the entrance. It was also located near a well that provided water to the nearby residents. However, it was not as impressive as the other tree, and did not catch anyone's eye.

Another majestic tree was a giant Ficus found in the back yard of a rental residence located at Turgeau in Port-au-Prince. Although the house was a large, two-story colonial situated on a huge property, no one could miss the Ficus tree standing deep in the courtyard. Its canopy covered four neighboring houses, and its roots spread down into the ravine. One could track them climbing on the other side. It dropped some fruit that resembled "guinep," which we were forbidden to touch, let alone eat. Colonies of bats unable to find refuge at sunrise were seen resting on balcony banister, window and door dormers, outdoor fixtures, electrical wires, and wall. Anything at reach was thrown above as an attempt to displace them, if only to a nearby location. In another layer of superstition, the adults warned us the bats could only see at dark. There were stories about a black cat that sneaked inside the house during the night. Large snakes and spiders too frequently joined the noisy crowd of children playing in the yard, disturbing the fun. Thus, all activities were consigned to the house until those creatures were evacuated and it was deemed safe to return outside. The occasional sound of a rolling bruhaha coming down from the tree and a slamming to the ground usually put an end to all loudly outdoor nocturnal gatherings, although there was nothing found on the site thereafter that might have caused the turbulence.

An adult male lived inside the trunk of the tree and oversaw the four neighboring houses covered under the canopy of the giant. This individual approached the family's nanny with the threat that he would like to eat three small green mangoes. The assumption was that three of the children in the nanny's charge were going to be eaten alive. These mysterious testimonies were ongoing. At one point, a family misfortune precipitated a speedy relocation. A classmate was overjoyed to become the new tenant, but this was a short-term occupancy, marked by a variety of unpleasant experiences. Other renters also shared tales of unsettling encounters at that residence. Those recollections were dormant for quite some time; however, during research into the modalities and types of remedies employed to treat the enslaved during colonization of the island, a digital literary document of *Pharmacopée* revealed the attributes of those species. It detailed their various advantages in treating the diseases that affected the locals. Ceiba was one of the trees cited for its curable attributes. Due to having the same reputation in the island, the Ficus became the subject of more intensive inquiry.

PURPOSE OF THE STUDY

Cultural speculations regarding the *Ceiba pentandra* and *Ficus thonningii* have long fascinated native Haitians. Their fixed beliefs regarding these species extend to no other local flora, although without reliable facts to justify them. Those trends are highlighted in this qualitative study, the purpose of which is to probe those traditional values while concurrently exploring the other characteristics of the trees relative to their medicinal and pharmaceutical attributes as well as their industrial usages. To this end, the plurality of information will come from various sources. The data comprise interviews with several groups of participants, observations from many sites and festivities, a study of soil sampling of each species, and an intensive literature review to reveal the primacy of these arboreal species in the Haitian landscape and belief system.

NATURE OF THE STUDY

Having anticipated the locals' beliefs regarding Ceiba and Ficus, as well as the vegetation's actual properties, it was best to channel the findings using a phenomenological approach in the search for meanings. No other design can better satisfy this inquiry for which it was necessary to obtain input from a wide range of individuals. The bulk of the research was conducted in in Haiti because these tree species are found throughout the island. In addition to proximity, cultural factors were also quite significant. For example, the dance around the silk cotton tree is a local custom best experienced in Haiti. One interview with an indigenous group was held in the main town of Gonaïves, located toward the north of Haiti, in the Department of l'Artibonite. The observation of the *Ceiba pentandra* and the dance around it took place in Grande-Saline, a village in Gonaïves. A native group leader was retained to facilitate the event and book the participants. An interview was conducted with the seniors at the University of Agronomy in Port-au-Prince, Haiti, commonly known as Faculté d'Agronomie et de Médecine Vétérinaire (FAMV),

Université d'Etat d'Haïti (UEH) and another group of prospective graduates from the School of Environmental Study and Sustainability at Columbia University of New York was selected to attend an interview. Examinations of the Ficus tree were held in the same locality and at a family property. A collection of soil sampling of the two species was sent to FONHAD, a local agricultural laboratory, for content analysis. The aim of this research was to receive input from several groups of individuals regarding their knowledge of and experience with the botanical species, to gather data from various sources including from a robust literature review. It was also intended to add to the existing literature and answer the following questions:

1. How receptive will Native Haitians be to learning about the many attributes of the silk cotton tree and Ficus species beyond their existing beliefs?
2. How feasible is it for the natives to change their beliefs when provided with sound literature regarding those species?
3. What will be a convincing, productive, and satisfying approach to derive from this study that will lead to positive social change?

METHODOLOGY

The focus of this qualitative study was to explore the vast and rich array of existing information relevant to the various attributes of the Ceiba and Ficus species while also examining how native Haitians perceive the flora in their culture. The investigation involved the descriptive and interpretive experiences of people; therefore, it conformed to the qualitative phenomenological study guidelines recommended by Hatch (2002). This approach, intended to also search for meanings Grossoehme (2014), fits the boundaries of the inquiry. As both Hatch and Grossoehme cautioned, a researcher's preconceptions must not interfere with the facts. Creswell (1998) suggested relying on imaginative and insightful presumptions of the experience, rather than using self-judgment and making loose assumptions. This approach is meant to comply with the concept of *epoché*, a term assigned by Husserl (2017), who developed the idea of the phenomenological method in 1913. Known also as "bracketing," this approach first exposes one's personal understanding of the phenomenon before one advance any reasoning, an ideal technique with which to remove biases.

An anticipated stance toward data analysis involves paying attention to the types of bracketing. Husserl (2017) proposed two types: a universal *epoché* that eliminates all assumptions and a local *epoché* that reduces them. Complying with this advice, an exposé of the researcher's experience was presented in the introduction. Thereafter, following a descriptive and interpretive approach, data collection displayed many facets, those of which were listed in the previous section.

THEORETICAL FRAMEWORK

In this study, various domains are presented, each requiring special attention. Therefore, selecting a theoretical framework that embodies all those aspects is an immense task, encompassing a plurality of themes and variety of categories. General system theory offers the parameters to frame different elements that are or are not necessarily connected. Von Bertalanfly (2006) opted for an application of systems that can be physical, biological, or social in form, further arguing that a system has various fields with differences, similarities, and isomorphous styles. The elements can be of a different nature but use the same model. They can also be dissimilar yet classified in the same group. One aspect of this theory can bring light to the issue of intergenerational communication where some messages are passed on in a system and some others are not. The concept of autopoesis derives from general system theory, which provides the explanation for this phenomenon within a system that develops its own set of operations and establishes a network to develop additional operations. Some warnings from Von Bertalanfly involve the isomorphic aspect of a system, respective of its application to distinct phenomena. However, this is not an obstacle to the present research, because the aim is an attempt to find some facts about the operation and the operational causes within, a concept elaborated by Luhmann (2013).

DATA COLLECTION PROCESS

Numerous studies were selected to explore the attributes of *Ficus thonningii* and Ceiba genera with several authors providing in-depth inquiries on the healing benefits and numerous industrial applications of those flora alongside the cultural beliefs of Haitians regarding them. This information was the core of the literature review. Additionally, data were collected by way of interview method with a group of people in Haiti and students from the University of Agronomy in the country. It was equally important to access information from the seniors enrolled in the fields of ecology, environmental sciences, and related disciplines at Columbia University in New York. The input of university students was necessary to uncover what they learned in their program regarding those flora. Soil sampling analysis where the trees stood, observation of the landscape, and the dance around the Ceiba supplemented the information. The Haitian students participated in the interview at the University of Agronomy located in Port-au-Prince, Haiti. The researcher met the folk group of ten individuals in a hotel located in Gonaives. At Grande Saline, which is a rural locality of Gonaives was where the dance around the Ceiba occurred and the soil sampling collected. The observation of the landscape extended throughout various regions in the island.

The interviews conducted with the ten scholars in the U.S. took place in one of the multi-purpose rooms at Columbia University's campus. The face-to-face encounters occurred in a time span of several days with all parties. The participants who signed the consent letter were between the ages of 18 and 50. Official and local affiliates facilitated the recruitment process. The interviews composed of thirty questions excluded the demographic information of each participant and although the content was similar for the university students, it was different for the folk group. The interviews were conducted in French, Haitian Creole, and English, depending on the preferred language of the interviewees.

The observation of the landscape and the dance around the Ceiba was non-inclusive on the part of the researcher. Soil sampling analysis where those trees stood supplemented the information. The tests were conducted at Fondation Haitienne de Development Agricole Durable (FONHDAD) in Bas Boen, Haiti, which is a well-known laboratory that uses modern and holistic techniques in agricultural research and training. Both tree species were from the Department de l'Artibonite region in the commune of Grande-Saline at approximately one mile from each other. As required by the testing laboratory, two cups of soil in which each of the species was rooted were submitted for the study. They were collected by local farmers who assisted in digging the soil. Retrieved at a depth of 1 to 2 feet in the location closest to the trunk and around the large roots, they were placed in separate Ziploc bags and secured in individual padded envelopes labeled with numbers at the researcher's discretion. The soil samples were hand delivered to the lab for analysis.

The Landscape of Haiti

The trees in question are scattered throughout the countryside. Based on records obtained from the Haitian Ministry of Agriculture, the country is divided into ten departments that vary in size, farm production, forestry, resources, population, and boundaries. Within each department are regions called "communes," which are subdivided into cities. Some regions are known to produce specific crops. However, cultivation is uniform throughout the country. Large trees, such as the silk cotton tree and Ficus, are found throughout all regions. In areas larger in superficies, one can expect to find more of those species, although they are not necessarily concentrated in one locality. No count of those trees throughout the country was on record. Thus, one must be familiar with a particular region to know where the trees exist.

The Ceiba and Ficus trees have no boundaries in tropical landscapes, although they typically grow near rivers, wells, streams, or ravines; they can also be found in dry coastal areas in regions such as Puerto Rico (Dani and Chinea-Rivera 1990). *Ficus genera*, however, are found among any type of vegetation. Hendrayana *et al*., (2018) observed that those flora grow in wet, dry, rocky, limestone, and coral soils, and at altitudes as high as 1,500 meters. On La Gonave, an offshore island in Haiti, silk cotton trees once grew widely. This location, known as *Plaine de Mapou*, is the only area in the country where those trees were found in such abundance (White, Shao, Kennedy, and Campbell 2013). The majority, however, have been destroyed by humans who used the wood to build houses and make cooking charcoal. This region continues to carry its name for the few trees that remain standing. In Haiti, the mingling of these flora is a natural trend, as they exist throughout urban and rural locations, including farmlands and remote areas. This type of integration is not arbitrary, but part of a system now known as agroforestry.

Agroforestry is a multi-functional method of using the land. It allows farmers to benefit from environmental factors such as adaptation to climate change, versatility, variety of crop production, ecological sustainability, financial prospects, and food production. Agroforestry, which gained prominence in the late 1970s, goes beyond the farm level in preserving the ecosystem to benefit watershed management, biodiversity, conservation, and carbon storage (Lasco *et al*., 2014).

LITERATURE REVIEW

Species such as *Ceiba pentandra* and Ficus are carbon storage sources; these are unevenly allocated in the various parts of the tree. For example, Thiruchenthil *et al*., (2014) discovered that the stem of the kapok tree carries the largest percentage of carbon, followed by the root, the branch, and the leaf regardless of the age of the trees involved in the study (1−12 years). The biomass of those species varies according to their elevation and individual genus, while the carbon they store measures half of their biomass. In some fig species, photosynthesis is responsible for a percentage of the carbon supply involved in their reproduction, construction, and respiration (Grison-Pige *et al*., 2001).

One interesting aspect of the giant trees is their reproduction. Like their counterparts in the vegetable kingdom, they are not exempt from pollination. Bat pollination does not take place on Ceiba plantations that are too dense (Zeven 1969), because of the difficulties accessing the crowns of the towering trees. However, cross-pollination is possible among trees when mild winds occur. Bats, particularly those in the Phyllostomidae and Pteropodidae families of the New- and Old-World tropical regions, respectively (Thiruchenthil *et al*., 2005:1679), are responsible for the pollination and seed diffusion of several important plant types and species, including the Ceiba. In addition, bats, bees, moths, insects, squirrels, and birds amass the nectar to achieve pollination; where artificial

pollination is done manually, it is most successful when performed at night or early morning. Zeven also mentioned the process of asexual reproduction that contributes to the growth of new plants via their extended horizontal roots.

These processes gave rise to two distinct groups of the Ceiba species found in Africa and the Americas: the wild and semi-wild caribaea and the cultivated indica (Zeven 1969). The caribaea group includes two subgroups. The first is the caribaea-forest type, which can reach up to 35 meters in height and is characterized by its extensive buttress (i.e., aerial roots that help stabilize a tree) and high crown. The second is the caribaea-savannah, which grows as high as 10 meters and has a short trunk and huge buttresses that would stand out in any location. The indica group has a small buttress, can grow up to 25 meters, and displays the characteristics of the habitat where it grows. One type derived from the indica is the "pagoda," which sheds lower branches and features an empty stem with a crown. Zeven also noted a second type, the "Lanang," which retains its lower branches as its canopy curves to touch the ground. However, Ceiba has roots in several other regions. The species predominates in the tropical forests of West Africa, its land of origin, in Southeast Asia, its foreign home, in Mexico, Brazil, and South America. It grows in India and is also common throughout the West Indies in countries such as Bahamas, Haiti, and Dominican Republic. Data regarding this species vary according to the era the survey was conducted. Based on taxonomical data, there are various other genera of Ceiba pentandra. Plumier identified two types in the Caribbean: *Ceiba viticis foliis* or *Caudice aculearo* and *Ceiba viticis foliis* or *Caudice glabro* (Ducoeurfoly 1808). Ducoeurfoly named three others discovered in that region: Ceiba red or mapou rouge, a darker Ceiba red called colorade by the Spanish, and another simply known as Ceiba or mapou, which the natives identified as *bois de fléau*. Regarding the taxonomic revision of Gibbs and Semir (2003), in addition to three species found in Mexico, the Caribbean islands, and Central America, there are 13 other types of Ceiba known in South America. In a recent inquiry, Pezzini *et al*., (2021) stated there were approximately 18 different types of Ceiba species: 10 in South America, 3 in Central and North America, and 5 in Latin America.

The Ficus species are among the largest genera of tropical and sub-topical zones worldwide. They are the twenty-first largest seed plant (Ronsted *et al*., 2008). Mawa *et al*., (2013) noted that this species comprises some 800 plants, which are partitioned into six subgenera based on their preliminary morphology. The largest group is the monoecious subgenus known as Urostigma, which comprises 280 species. Ronsted *et al*., believed that it covers half of the species, while the remainder comprises the dioecious genus. All these trees are called Ficus, a name usually followed by a particular botanical designation. Pollination also occurs throughout the Ficus species. A type of fig wasp from the Agaonidae subfamily is responsible for pollination among the genus (Kerdelhué *et al*., 1997), an exclusive task of the females for over 60 million years, with some exceptions, such as when many wasps pollinate one Ficus, or one wasp fertilizes more than one Ficus. This flora has different life forms, dependent on how it grows (Hao *et al*., 2011). One category is the hemiepiphytic Ficus (H), or primary hemiepiphytic. This type sprouts on the canopy of other trees before putting down solid roots in the ground to become an independent tree. It is also known as a strangler because of its ability to invade a host tree and survive on its own after the solid roots allow the structure to support its own trunk. Some epiphytes form multiple trunks interconnected by aerial roots.

Ficus tinctoria is in a category known as hemi-epiphyte (Hao *et al*., 2016) for lacking the ability to form its own trunk in the event its host tree dies. Non-hemiepiphytic Ficus (NH), also labeled secondary hemiepiphytic is the other type. This life form rises from the ground to ascend the host plant until it aborts contact with the soil. However, those NH can also reconnect with the ground and access land resources. Hao *et al*., (2016) suggested that the tree's ability to generate adventitious roots allows for this reconnection, adding that both Ficus (H) and (NH) are found in abundance in tropical vegetation, with approximate estimates of 500 and 300 species, respectively.

Cultural Beliefs of Haitians Relative to those Species

Ceiba and Ficus trees are found in many countries, but in Haiti, they are placed on a uniquely high pedestal. The natives not only venerate those species but also show profound respect to the sites where they flourish. In Haiti, many believe Ceiba and Ficus trees are a sanctuary for spirits. They revere the unseen and hold those trees in esteem because of who is thought to dwell in them. Various faunae also inhabit those trees, making their homes in the large canopies. The oversized branches, height, and deeply entrenched roots stun viewers far away. The occupants of those giant trees include snakes, spiders, bats, birds, insects, and other wildlife (Zidar and Elisens, 2009). In Haitian traditional religion, spirits have names and particular animals representing them (Mérat, 2012). The locals share the same special relationship with the giant species as they do with the unseen, which they believe to take animal form. Those species have earned a divine status in the island although other species may also be valued for their useful properties.

A known fact is that in many countries worldwide, people rely on traditional medicine to treat or cure chronic illnesses and everyday health symptoms. Despite the promises of advanced

pharmaceutical drugs, botanical species command high recognition for their properties. Trees and plants are known to be rich sources of nutritional and chemical ingredients. Apart from food consumption, they have long been used to prepare homemade remedies and medicinal treatments, a case to discuss in the literature review section. The lower cost of vegetal products and easy access are important for sustaining this widespread use, a common practice in Haiti. The locals respect the healing virtues of all arboreal types. The issue is that they maintain a different stance toward those two species. The trees considered in this study may well be excellent resources in other aspects, but for the believers, such uses are secondary. In fact, the natives' cherished views take precedence over verifiable scientific data. Cultural beliefs give far more weight to the healing attributes of the silk cotton tree (*Ceiba pentandra*) and wild Ficus tree (*Ficus thonningii*) than to any other uses.

Attributes of Ceiba Pentandra

Ceiba pentandra is renowned for its many phytochemical properties (Iroka *et al*., 2008). All parts of the tree are used globally and serve various purposes, having medicinal, nutritional, domestic, and industrial values. Present in *Ceiba pentandra* are alkaloids, tannins, flavonoids, resins, proteins, steroids, and terpenoids in substantial amounts. In Nigeria, kapok is known to be a reliable resource in medicine, utilized to treat various diseases. The wood is employed in Ghana in the making of superior plywood and blackboard (Toledo-Aceves and Swaine 2007). It is a practice in India to make ropes and paper from the red fiber obtained from the bark. A decoction purged from the bark produces a diuretic and an aphrodisiac supplement. It also treats headache and diabetes. Medicines that are made from the bark serve to heal wounds and intestinal disorders. The Ceiba species produces a gum that reduces the symptoms of upset stomach. Its soft shoots are used as contraceptive. The roots when boiled are consumed as a tea and help in the treatment of oedema and dropsy. Kapok is known to treat bleeding, fever, and spasms. The seed pod of the tree is a source of fiber that resembles a fluffy cotton, which is used to stuff cushions, pillows, and mattresses (Gawali, 2014). The fiber serves as thermal insulator for icebox, refrigerator, and cold storage plants. It has the qualities to be water repellent and therefore is an ideal product to use for life jackets, lifeboats, and various marine safety equipment. It contains sound internally when used as insulator in offices, theatres, and aero planes. The fiber is employed as an absorbent material in various industries primarily in hospital for the maintenance of beds that often must be sterilized and must keep their original qualities. There is a high possibility that the fiber obtained from the kapok can produce cellulosic ethanol. The seeds are utilized in the making of soap and fertilizer. When they are roasted, pounded, and grounded, they can be eaten as a meal or mixed in a pot of soup. The oil extracted from the seeds has various purposes. It is a culinary ingredient. It is a substitute fuel to lubricate lamps. It is a blend among many products when making soaps and manufacturing paints. The oil also serves as a substitute for biodiesel manufacture.

The kapok is a good oil absorbent that can be reused after recovery (Lim and Huang, 2006) (Gawali, 2014). High-quality cotton can be made from its flowers (Ducoeurjoly 1802). The nectar from the tree produces a desirable honey and a decoction made from the flowers relieves constipation. The blossoms and the fruits are prime ingredients to flavor sauces. With the pollination of bees, the flowers produce a special kind of honey with a unique taste and color. The leaves have a soothing effect. The fresh ones, when they are compressed are ideal in relieving dizziness. An infusion made from the leaves eliminate cold symptoms such as cough and sore throat. They add a great taste when preparing gravy and are an abundant source of meal for goats, sheep, and cattle (Dani and Chinea-Rivera 1990). Akaneme (2008) added that when the leaves are boiled and cooled, the consumption of one cup three times a day can prevent miscarriages. It also serves as a remedy to reduce blood sugar levels. Leaves at low proximity to the ground are usually consumed by goats, cattle, and sheep.

The wood produces a low quality of timber that can easily be applied in making furniture that has no superior value. Several products are made from the wood of Ceiba. Plywood is the primary one followed by boxes, pulp, crates, matches, musical instruments, farm tools, fuelwood, lumber stock, packaging, card stock, paper products, and light construction materials. In some regions, canoes, and rafts are made from the wood of ceiba. The light weight of the wood makes it flexible and easy to manipulate in the fabrication of masks, a traditional practice in West Africa.

Attributes of the Ficus

Ficus thonningii is known to produce many non-nutritive chemicals as a means of defense against biotic and abiotic threats such as flavonoids found in various parts of the tree, alkaloids, terpenoids, tannins, and essential oils. This species also contains many phytochemicals with antibacterial potentials (Oyelana *et al*., 2011). The leaf extract of *Ficus thonningii* possesses antifungal, anti-inflammatory, and antioxidant properties. It has pain-relieving effects, and its anti-inflammatory qualities are used to treat rheumatoid arthritis and asthma. It also has cardioprotective effects. The flora contains resveratrol, which acts against the progression of cancer cells and cardiovascular diseases. Its extract has hypoglycemic attributes, as demonstrated in a study that found a decrease in the glucose level of rats after they were injected with doses of the extract (Dangarembizi *et al*., 2014). It is assumed that the ethanol contained in those

trees aids in controlling diabetes. Although *Ficus thonningii* lacks an antineoplastic effect against breast cancer in humans, there are others in the Ficus family that may be efficacious. *Ficus hispida* possesses the curable properties to treat this condition. *Ficus carica* is traditionally reputed to treat cancer, inflammation, and gastric disorders (Mawa *et al*., 2013). *Ficus thonningii* has the healing elements that decrease intestinal activities that cause diarrhea and there are no risks of toxicity when consuming its extract in low doses, as well as no potential kidney damage or mortality risk Dangarembizi *et al*.,

The Ficus taxonomy intermingles with a variety of species, and its benefits are claims are claimed to be numerous Dangarembizi *et al*., (2012), Orwa (2009). In addition to be an efficacious vermifuge, the species produces a white latex or rubber that becomes pink after a while and has the potential to cure ringworm, tooth decay, and fever. Drops of milk extracted from the latex are applied to the eyes to treat cataracts. It is further reported that in regions where agroforestry is the system of land management, Ficus intercrops with coffee and bananas. Among its abundant attributes, this genus protects the soil. The branches, when expanded toward the ground, serve to control erosion. Its leaves prevent nutrients from escaping the soil and are also useful for water storage. The limbs are a useful source of firewood, and Ficus fiber is used to make cloth, mats, and ropes strong enough to fasten bundles of firewood. Its stretched appendages shelter and shade livestock. *Ficus thonningii*, when combined with other plants and herbs, has various curative properties. A mixture of the species with basil, soursop, and bamboo is a good remedy for respiratory disease. A mélange with palmyra palm is ideal for massaging and bathing. It also helps with pain relief in people afflicted by paralysis and polio.

The Ficus species has a reputation as an abundant source of vitamin E and has been used for centuries to treat diabetes (Deepa *et al*., 2018). In several countries in Africa, the leaves have good nutritional value and are used as a source of protein. They are valuable in ethnomedicinal practice in many countries in Africa. Traditional healers have used the leaves to treat ailments such as diarrhea, ulcers, impotency, wounds, diabetes, gonorrhea, gingivitis, liver disease, bone disorders, stomach pain, ulcers, and ringworm.

The leaves are reliable source of protein and are consumed as a vegetable in certain regions of Africa. Along with the fruit, they are rich in calcium, magnesium, and potassium. When ripe, the fig fruits make tasty jams and are delicious in alcoholic beverages (Orwa *et al*., 2009). Fallen fruits provide a thorough source of nutrition to pigeons, bats, baboons, parrots, and various insects. Livestock prefers eating dried leaves on the ground rather than the fresh ones, while giraffes and elephants are among the large animals who eat the leaves and twigs.

In addition to the leaves and fruit, Ficus stem bark has various medicinal purposes. The infusion made from the pounded stem bark is reported to alleviate rheumatism, influenza, and all related cold symptoms. It is also a relief for inflammation. Its use varies in different countries; in Tanzania, for instance, women take an infusion of stem bark to stimulate lactation, while in South Africa, people consume it for both constipation and diarrhea. In other parts of Africa, the bark decoction serves as a remedy for infertility and to regulate the menstrual cycle. Bark cloth is a product made from the bark while the wood is employed in fencing, firewood, and construction Dangarembizi *et al*., (2012).

The roots have many benefits in traditional treatments, such as preventing miscarriages and nosebleed. They may cure malaria, hepatitis, dental, chest and stomach pains, fever, diarrhea, and pneumonia. It is further believed that the roots are useful in treating illnesses associated with evil spirits (Dangarembizi *et al*., (2012). These species, however, are not immune to natural destruction. They are at risk of bush fire caused by lightning or human error. They are destroyed purposely for lumber in the construction of houses, boat, furniture, and to make charcoal for cooking. The lumber is applied in various industries.

Threats and Diseases Affecting the Species

Insects and Termites

An inevitable threat come from fungi and insects quick to attack the wood or timber and other parts of the trees. Termites like Lyctus beetles and other insects infest the wood of those florae. The trees are also vulnerable to fungi such as white-rot and blue-stain types. The pathogens produced by the fungi cause various diseases such as leaf spot and anthracnose that delay the growth of seedlings.

Ficus timber has a strong texture; however, it is also unfortunately a perfect medium for termite colonies. Several pests attack the fruits and among those, caterpillars, mealybugs, and longhorn beetles penetrate and damage the leaves and the trunk. They build tunnels along those surfaces which pose harm to the foliage. When mealybugs and scale insects invade the tree, they suck the sap and infest the leaves, the fruits, and the branches, which cause rot and precipitate drops. Ceiba *pentandra* is not exempt from insect borers. During rainy seasons, different insects attack the outer layer and the sapwood of the timber of this species. According to (Apetorgbor *et al.*, 2004) there were nine distinct types of woodborers identified on those logs that are from three families of Coleoptera, which refer to the beetle genus. The types of beetles

identified were the Platipodidae known as the ambrosia beetles, the Bostrichidae, which are in the category of horned powder-post beetles, and the Scolytidae, also called bark beetles. Among the various lumber studied in relation to their risk of infestation during dry and rainy seasons, Ceiba Pentandra was first at risk of infestation during rainy season and second during dry time. Ordinarily, insects can be seen when they invade parts of the tree. This assault can be controlled successfully with preservatives for some borers, while others are resistant to this type of treatment. Ceiba pentandra, while highly vulnerable to termite threats, retains the treatment of effective preservatives (Faruwa *et al*., 2015).

Fungi

Apart from insects and termites that damage those flora, fungi infestation is another destructive threat to them as much as they are to all species. There are many undiscovered facts about fungi. However, it is known that fungi are found in most habitats on this planet. There are six times more fungi than there are plants (Yamin-Pasternak, 2011). This explains their presence in large numbers everywhere. Blackwell (2011) suggested the number of fungi species varies between 3.5 to 5.1 million globally. Among those, 80,000 are identified (Peipenbring, 2006). Many remain uncounted and the unknown ones are mostly centralized in tropical regions where the most diverse types exist. It is believed that terrestrial fungi were created from the association of algae with a non-septate fungus, just as land plants evolved (Selosse and Tacon, 1998). They remain in the roots of plants and together form a mychorrizal union, also called mycorrhizal network (Simard, 2009), providing the fungus does not bring a disease to this association. It is alleged that underground fungi have architectural properties (Toju *et al*., 2014) relative to plant species. During symbiotic and non-symbiotic relations, fungi form distinctive connections to provide nutrients favored by specific types of species. The mychorrizal fungi union forms two branches (Blackwell, 2011): arbuscular mycorrhizal fungi (AMF) which form the network with plants and ectomycorrhizal fungi divided in two groups: microfungus and macrofungus.

As per Blackwell (2011), AMF are more common. They are found in 80% of plant species and 92% of plant families. AMF originally date to the time plants occupied the land (Birhane *et al*., 2020) and form their network within their cluster of seedlings. The first group of ectomycorrhizal fungi or the microfungus is composed of those that are invisible such as bread mold or black spores. The second group, which is the macrofungi, represents the mushrooms. It covers 10% of the entire fungi species. Among those, 21,679 names were identified while 35,000 additional ones remain unnamed and uncounted in various regions, making the number of discovered and described macrofungi between 16 to 41% (Mueller *et al*., 2007).

Fungi are unseen. They hide in the soil and entangle with roots. They are in substantial number and are responsible in maintaining all living things. Fungi are known to sprawl underground for many miles, and it is assumed that they are the largest organism on the planet (Sheldrake, 2020), forming a network of arbuscular mycorrhizal fungi AMF throughout their path (Pennisi, 2004). AMF, like fungi, remain hidden in the soil and are stored in plant roots, supplying them soil minerals like nitrogen and phosphorous. Fungi are fundamental to their host plants because of their role in transporting to the roots carbon, water, and nutrients such as nitrogen and phosphorous. As per Simard (2009), mycorrhizal networks facilitate this transfer by using their nodes or interacting when they are at proximity to one another. Their responsibility and function are also vital in promoting the survival and the growth of plants. Some fungi are known to pose harm to plants, to trees, and to agriculture. Wheat rust or corn smut grow on living plants and can affect harvest. Fungi are the cause of diseases in human such as ring worm, skin rash, oral thrush, candidiasis, and athlete's foot. Other types of fungi are the source of food such as mushrooms and truffles. They are used as yeast to leaven bread dough and baking goods. They serve as an ingredient in the fermentation of sugar to alcohol. They recover and distribute nutrients into the ecosystem in addition to supplying them to the roots of plants. In tropical regions, fungi are a rich source of protein (Zent *et al*., 2004). Many are commercially used in the making of antibiotics such as penicillin to cure infection and statins to control cholesterol (Blackwell, 1998).

The entire Ficus species is a medium for pest and fungi infestation. Some fungi are airborne, and others attack the trees inside the wood and spread on the branches, and on the leaves. One type of airborne fungus infecting the species is called Botryosphaeria. It has been located on Ficus trees and in agricultural crops in some areas in Los Angeles. It takes the shrub three years to die from the time of the incursion. Generally, Ficus trees are subject to be attack by a total of thirty species of fungi (Orwa et al, 2009). Those fungi have minor importance because they can be managed with chemical treatment. Decorative Ficus may also suffer from the damaging spread of fungi. Known as Ficus Blight, Botrytis Blight, and Southern Blight, they can invade the tree and other plants nearby in the garden. Martinson (2012) justified that the transfer of pollen is facilitated by fig wasps from one tree to the next during pollination while the invasion of fungi is being dispersed throughout. Therefore, any disease present will be transported to the neighboring species, which will alike be infected.

Several fungi species were identified to invade Ceiba pentandra more so during the rainy season than during the dry period. Diverse types of mushrooms were identified to cause diseases to many crops. In a study conducted by Apetorgbor *et al*., (2004), Penicillium citrinum was among the fungi detected in Ceiba Pentandra to be in majority. Further, Penicillium citreonigrum is a parasite present, the cause of yellow rice disease. The wood of Ceiba pentandra was also found to be an ideal platform where diverse types of molds congregate. Red bread mold, black mold, oak wilt, common mold, and many members of the mold family were among the invaders. It is possible that those intruders not only occupy the lumber of this flora, but also its other parts such as the fruits and the leaves. The association of fungi with crops, human health, and nutrition goes further. They have another relationship existing with human for the role they play in traditional cultures.

Fungi and Culture

The history of fungi and culture goes back to ancient times when diseases affecting agricultural species were thought to arise from the wrath of the gods. These organisms are perceived differently depending on the culture. According to Zent et al., (2004), the Hoti communities located in a region of Venezuela use fungi for ritual, magical, religious, and spiritual purposes. They have names for fungi, mainly the mushrooms, which are called "food for the vulture bush spirit" (p. 57) or "food of the malevolent bush spirit" (p.58), while known concurrently to be a source of proteins and other important nutrients. The natives of that locality perceived mushrooms as a sign of good luck when those that grow in the wild are consumed raw or cooked before going hunting. They are mixed with bark, leaves, roots, and other ingredients to compose a potion for strength, endurance, and luck. The hunter would have known the type of mushrooms to eat to capture a specific animal.

Little is known about the Haitian culture relevant to its association with fungi whereas the testimonies of the natives in terms of their beliefs with invisible spirits that reside in various species compose a local narrative. *Ceiba pentandra* and the wild *Ficus* are thought to host all types of spirits. The assumption could be that just like fungi, there are several types of spirits and various categories, having distinct purposes, playing specific roles, having diverse names and found species. Also, like fungi, some of those spirits might be destructive to species, cause disease, and affect agriculture. However, this information is not documented in any literature and is only speculative. However, the lives of fungi and other vegetation are in fact inseparable. (AMF) form a network within plants and keep them connected with one another. It is reported that 90% of the plants rely on mycorrhizal fungi for the transport of nutrients and the defense of plants (Sheldrake, 2020). Fungi and mycorrhizal fungi are also responsible in the decomposition of decayed debris found in the forest while additionally forming symbiotic liaison with the roots of plants (Bertelsen, 2013). They are implicated in creating the spores that are carried by wind before turning to rain drops. Even as they perform this significant role, mycorrhizal fungi remain invisible and live in roots (Sheldrake). This last aspect of the invisibility of the network established underground by mycorrhizal fungi seems to suggest some similarities along the belief found in the Haitian culture insinuating the interaction of invisible spirits living in trees. In that context, the culture shares a similarity with fungi. Owing to the virtues of fungi, Haitians benefit by harvesting a rare type of black mushroom called "Djon djon." It grows in the North of Haiti (Bertelsen). There are opinions among the locals. Some say that it grows freely in various parts of the country on decayed woods and on abandoned compost while some others believe that farmers must clean the soil, remove all the weeds, and clear the area off all unnecessary objects in preparation of the growth of this mushroom. This ectomycorrhizal fungus does not need seeding. It is harvested during yearly rainy season in the island in the same loamy area. Even a little bit of human spit dropped in the soil is a reason to disqualify the harvest of "Djon djon." The fungus is hand-picked from the dirt and put to dry. This mushroom is not eaten. It is mixed with warm or boiled water. The black extract obtained from the blending or straining is used in the making of rice, corn, and poultry. It is sold throughout the country, yielding a delicious dish that the natives consume during holidays or special occasions. Not much is known about the attributes of this mushroom relative to its chemical attributes. Generally, fungi carry some level of iron, being the fourth most copious element in earth. They have trace of manganese, copper, and zinc. They possess the accumulation of micronutrient such as calcium and macronutrient like potassium (Jellison *et al.*, 1997). The speculations are that the extract of "Djon djon" is a healthy drink loaded with Vitamins A, B2, B6, protein, and calcium. It reduces inflammation and *is an agent for anti-aging.*

The Role of Fungi in Carbon Storage

In general, trees are responsible for carbon storage, particularly the large varieties. Sharma *et al*., (2021) perceived many ways trees can suppress atmospheric carbon (CO2). CO2 can be converted to above- and below-ground biomass by autotrophs; however, trees have major potential to sink and sponge carbon, which they retain for a long time before releasing it into the atmosphere. Also observed was the trees' lifespan, extent of the arboreal species at maturity, and rates of development. All of them are accountable in the percentage of carbon sequestration each year. In agroforestry systems, when carbon is removed from the atmosphere, it is stored in long-

standing pools, which are the above-ground plant biomass, and the below-ground plant biomass, which includes the roots and soil microorganisms (Nair *et al*., 2009). Carbon allocation is indispensable to plants because it is necessary for their survival and development (Mannerheim *et al*., 2020).

Water and nutrients are transported to plants via the xylem, while carbon is distributed by means of the source and sink tissues. Plant growth requires source tissues to produce and export carbon, while the sink tissues import carbon. The net sources of this element in trees are the well-established leaves that grow profusely in the canopy. Carbon, like water and nutrients, travels from one plant or tree to others. Arbuscular mycorrhizal fungi (AMF) are responsible for exchanging carbon and facilitating its storage in the soil (Birhane *et al*., 2020). AMF obtained from higher biomass of fine roots are involved in this activity. Simard (2008) believed this exchange between trees is made possible through mycorrhizal networks formed with nodes linked to other plant life, which allow a form of systemic communication, where chemical signals occur, and resources are shared. However, Mannerheim *et al*., (2020) was uncertain that carbon transfer by means of AMF can protect the subsistence of trees. Nevertheless, those flora have a significant role in the storage of carbon and potential ability to sequester and reduce atmospheric carbon (Hangarge *et al*., 2012). Sink tissues distribute carbon to the roots, fruit, flowers, and, in Ceiba, to the young leaves with decreases as the tree ages (Zoth and Winter 1994); AMF must be highly instrumental in this transaction.

RESULTS

Interviews Conducted with Students at Columbia University, in New York, NY

The seniors who participated in the interview were in three different programs, yet they had no knowledge about the species being studied. Their course of study did not cover those flora. Among them, there were three students who were native Haitians and heard about those trees by name when they were growing up on the island. However, they did not have any information regarding their numerous properties. Two students of Asian descent also had no knowledge about those species, although the Ceiba predominantly originated in Asia. These students grew up in the United States and were therefore not familiar with the trees. Their contribution was minimal because the topic was foreign to them.

Interviews Conducted with Seniors at the University of Agronomy in Haiti

Ceiba

The seniors from the University of Agronomy in Haiti were from various regions throughout the country with a variety of religious backgrounds. None were married, had children, or were employed. Although they were familiar with silk cotton trees and Ficus to a certain extent, their program of study did not include a course relevant to those species. Agriculture is spread throughout an agroforestry system; therefore, the prospective graduates come across those trees in many plantations when they are in the field. As part of their training, they were required to educate farmers on techniques to care for the crops covered by shade from the extended branches of various florae, including the Ceiba and Ficus. The academic formation obtained from the university prepares them to acquire knowledge for healthy and sustainable farming in the cadre of food production. The program covers little to no literary content on those botanical species; thus, the data the seniors provided had no scholarly basis. The students had learned about those species from the information passed on to them by their parents, other elders, or the locals. The students reported seeing the Ceiba in their neighborhoods and other locations.

Specific cultural assumptions and stories were shared by the interviewees. The silk cotton tree is perceived as the guardian of the plantation. The agricultural landscape in Haiti is an agroforestry model that enables various crops to grow in the same locality. It has been reported that intruders who enter the farm guarded by a silk cotton tree and harvest crops without permission will die. Some recount that when the branches of this tree are bent down, one can see people's feet underneath, as if they were hanging on those limbs. The twisting or breaking of a branch is an indication that something drastic will soon occur in the region. This tree cannot be pruned or cut down. Because of the size of the trunk and limbs, the silk cotton tree has a mystical reputation known by everyone who resides on a property where such a tree is found. It is believed that spirits lodge in those trees; a scarf wrapped around the trunk indicates that a deceased individual resides there. The Ceiba or mapou has an historic label because of its association with the ceremony of Bois Caiman held by the enslaved people in Haiti preceding the insurrection that led to the independence of the colonized country. This tree is seen as a sign of grandeur and respect.

Regarding the ecological benefits of the silk cotton tree, it protects the soil against erosion and degradation. It prevents variations in the ecosystem and maintains its stability. Moreover, the trees grow near water sources. The deep and expanded roots retain water and keep the soil fresh, which enables soil conservation and provides shade to crops such as coffee and cacao. Those trees are also known to absorb all available nutrients from their surroundings. Their enormous size makes them resistant and sturdy; they spread easily and can cover an entire landscape with ample leaves to provide oxygen to benefit humans while consuming carbon dioxide.

One senior suggested that the meristem is primarily responsible for the height of the trees and plays a secondary role in the diameter of the trunk as much as the expansion of the large branches. The silk cotton tree's roots are structured according to haptotropic effects, which cause them to deviate upon contact with solid objects, with a geotropic action that provokes them to grow toward the center of gravity. Their wood is used to make furniture and charcoal for cooking; tea is made from the leaves to cure various unspecified illnesses. However, these trees are not used for pharmacological purposes in Haiti, because most people are afraid to sample parts of them for distinct reasons. The trees are long-lived and are a resource or habitat for diverse life forms, including birds, spiders, and snakes. Their extended lifespan and their size embody strength and endurance. They outlive many generations and are resistant to weather extremes and disasters. Thus, they are as highly regarded and labeled as the perpetual residence of the spirits.

Ficus

Two Ficus trees stand in the university courtyard. One is dying; some of its limbs were cut to accommodate new construction to rebuild edifices demolished after sustaining severe damage from the 2010 earthquake. The other Ficus, located in the center of the courtyard, appears alive and healthy. The seniors did not know the trees' ages. They had also observed these types of trees in other localities. The information they do have regarding them was passed on by their elders. Though their academic program did not cover relevant topics, the group reported that it is common knowledge that Ficus prevent crop cultivation because they absorb all the surrounding nutrients. They spread wildly, their roots scattered all over and far away from the trunk, amassing food to transport to the leaves. The trees grow in areas with nearby streams. They live a long time, and their presence defines the space due to their immense size and abundant shade.

An unusual feature of Ficus reported by the seniors is that they have roots forming from the stems and vertically descending to the ground. It is believed that people are not allowed to cut the branches of this tree; however, when the trees fall, the wood is used to make charcoal. This genus has no known pharmaceutical value in Haiti. In Haitian lore, one is discouraged to walk near those trees at night because they not only shelter various faunae but also house spirits. People fear the Ficus because of its mystical reputation. The seniors reported that they did not gain their knowledge about the species in their agronomical academic program because it covers botanical crops used in the food industry, with little focus on those with medicinal properties.

Interviews Conducted in Haiti with an Indigenous Group in Gonaïves

General Reflections of Native Haitians

Participants were familiar with the flora in question and recollected having them near or at their residence at some point in their lives. The group of locals identified the trees as protectors of the environment, believing the Ceiba and Ficus will not be extinguished, for they are the foundation of the planet. Those species are revered because of their efficacy and reputation in treating various diseases, their ability to store water and protect the fields during hurricanes, as well as their role in sheltering various faunae including snakes, frogs, spiders, and birds. In addition, the trees provide much-needed shade and give off pure oxygen in the environment as well as fresh breezes. The locals found the Ceiba and Ficus to have identical characteristics in many ways.

The silk cotton tree and the Ficus have several similarities beyond their size. They are long-lived, used in the treatment of various ailments, and known to house spirits. These trees are the center of traditional dances; the dance around the silk cotton tree is extremely popular, though not unique to this species. The locals reported that people dance around the Ficus as well, which is a way to say thank you for the service the trees render to humanity, including their manifold resources, role in the ecosystem, and usefulness in treating ailments. The celebrations around those trees can be performed at any point throughout the year, depending on the owner of the property where they are located. "It is not a custom to practice one specific type of dance around those trees," explained one participant. However, in the past, the most popular folk dance around those trees was called "Dahomey."

Ceiba

Commonly called "mapou" in Haiti, and known as kapok, the Ceiba tree symbolizes miracles to the locals who regard it as a rare resource, not to be taken for granted. Any property on which these trees grow is considered blessed because of the Ceiba's beneficial characteristics. Found near rivers, these trees have both supernatural and practical qualities. Someone who sleeps under one of these trees will have good dreams that reveal how to remove life's barriers. It is said that the elders speak their problems to the tree and shortly resolve them, which is why it is called a miracle tree and thought of as chief among the various arboreal species. Without being precise, when the leaves are boiled, they can treat various ailments.

The trees lodge all spirits and have long lifespans. The size, height, and deep roots are unlike that of most other trees. They serve as a recreational site, where people gather to have picnics or rest while breathing fresh air. Of course, they do not mingle around those trees without permission from the property

owner. Interestingly, native Haitians believe the trees can move to a location nearby and later return to their original spot. No one has ever seen the movement—the walk, as the interviewees called it—at the time it occurred. They determined this based on their own observations, claiming to note changes in the tree's proximity and positioning. The participants could not provide an explanation for this type of phenomenon, other than that the tree is mystical.

Regarding the tree's therapeutic uses, the locals acknowledged many medicinal attributes and independently reported that tea made from the leaves cures headache, hernia, and stomachache. The brew also controls high blood pressure, diabetes, and fever. The trees produce flowers, used when making linens. When the flowers are grilled, the ashes are used to heal the umbilical wound of newborns. The crushed leaves can be applied to wounds for healing. The kapok seeds can be eaten and are also used to produce an oil that is processed to make soap. The roots produce a syrup and a milky substance reported to cure anemia and other medical conditions. The locals have used the seeds to make buttons for clothes.

Ficus

The Ficus species is also known to be a giant, and like the Ceiba, has several medicinal and functional properties. The trunk releases a clear glue used to make soap and imparts a special flavor when added to legumes. The seeds are used to alleviate stomachache. When the leaves are folded, they release a milk-like substance, which can be applied to wounds for healing. Tea made from the leaves can relieve headaches and cure paralysis; however, this brew, according to local lore, must be consumed at sunset. The bark is applied to prevent the effects of malignant charms. It also makes a refreshing drink. The consensus of the interviewees was that the Ficus tree is a sanctuary for spirits. When grown on private land, the proprietors decide when and how to celebrate the spirits therein. The natives regard the trees as a major asset to the ecological system, as they protect the soil against erosion. Ficus trees have a long lifespan in addition to their loftiness and massive size, which allows them to dominate the landscape.

Observations

The first observations occurred in the location where stood the silk cotton tree. Another one was during the dance around the tree. A further glace at a Ficus tree on the family habitation and at two others in the courtyard of the University of Agronomy provided minor details. The Ceiba tree observed is in the commune of Grande-Saline, in the rural section of Poteneau, which is between the two main cities of the Department of l'Artibonite, Saint Marc and Gonaïves. Route Nationale No 1 is the main road connecting those regions. According to geographic data in that region, Grande-Saline extends on a superficies measuring fifty-two kilometers. In 2015, it had a population of over 23,000.

Observation of the Ceiba Tree

A body of water called the Canal de Drouin ran parallel to the property where the mapou tree is located. The main road, which bisects the location, made the flora visible to anyone passing through the area. The tree had thrived for numerous years, although its precise age is unknown. It is estimated to be approximately 80 years old, as people of various generations who grew up in the region have known it to always be that size and height. Part of the trunk toward its base was painted in teal and yellow shades, creating two bands around its circumference. In the immediate surroundings, there were no visible crops. Large trees in the vicinity were much smaller than the Ceiba.

The field was mostly invaded by shrubbery and studded with small rocks. The silk cotton tree was discernable at first sight. Estimated to be 60−80 feet tall, it was also wide, its diameter at the base appearing to measure more than 7 feet, excluding the roots, which extended in all directions. No houses were built directly on the property near the tree. A wall made of blocks separated the property and a modern house was located on the other side. The trunk was made of two trees attached to each other with what was a third piece joining them on the side. The branches were spread approximately ten feet off the base. The leaves were green, and the tree had no flowers in bloom.

Observation of the Dance around the Silk Cotton Tree

An indigenous group, consisting of men and women, traveled by bus to the site where the ritual took place around the mapou (Ceiba) tree. Upon their arrival, the celebrants began to clean up the field where the tree stood, and the dance would take place. They used small tools, sticks, or their bare hands to remove the debris found at the location (mostly empty bottles and over-grown shrubbery). Rocks were tossed to the side to clear the dance floor. A man brought a bucket of water and spread it around the mapou tree, to moisten the soil to prevent the dust from rising when the dance began. The men sat with their instruments facing what is called the front door of the tree, waiting for the women to get dressed in preparation for the dance. There were nine men present, including the bus driver, who was in reserve to attend to other duties. This individual was seen recording the event with his phone.

Six men played the drums, beating the drumhead either with their hands or a pair of sticks. One man blew through a bamboo pipe wrapped up in a white tube that measured approximately three feet in length while using a 6- to 7-inch-long metal stick to beat on a small iron platform. One end of the bamboo pipe rested near the ground between the legs of the player, who was sitting down, while the other end was

held in his mouth, leaving his hands free to beat the metal part. The group leader was in his forties. Besides blowing a whistle to give directives, he had a single "cha-cha" in his hand, and he initiated the rhythm to lead to the upcoming song. All the men were clothed casually in regular, non-matching garments and shoes. They sat on a bench and the chairs they brought with them.

After helping with the cleanup, the women dispersed from the set stage to put on appropriate dresses for the occasion. There was no locker room or backstage area in which to get ready. The bus served as a barrier and dressing room. The group of women had matching outfits. Each wore a white dress with a large collar dropping around the shoulders made of several bands a quarter inch wide in various colors. The same design was repeated on the end of the sleeves. The array of colors was replicated in larger bands to make a ruffled hem at the bottom of the swing skirt of the dress. Among the colors, olive-green and yellow were respectively duplicated in the fabric that served as a head scarf and waist strap.

To prepare for the dance, the musicians sat facing the door of the tree, where they placed a bottle before they began to sing as they played the drums and followed the group leader's commands. The head of the band lit a candle shortly before launching the prayer tune, which later reported was to honor the spirits residing in the tree. Thereafter, the candle was placed at the front base of the tree. The leader also held a white mug filled with water to sprinkle around the tree. He had a bottle of perfume that he sprayed on the dancers as they entered, and a large canister of talc to dust under the women's necks and around the tree. Holding a red scarf, blowing a whistle that hung around his neck, and shaking the cha-cha to the flow of the song, the organizer initiated the event.

The women entered the dance floor in small groups of even or odd numbers and gradually filled in the stage. The first bunch who joined the leader picked up the tune as they entered, and immediately their voices filled the air. The women were barefoot and appeared to be comfortable. Two of the dancers had a pair of brightly colored cha-chas in their hands, which they shook as they sang and danced. There were eleven women, who were all dancers and singers. They danced around the tree and circled it repeatedly while their vocal sounds echoed throughout the area. The sounds of the drums and the other instruments attracted bystanders, and the place was soon packed with curious viewers. The group leader welcomed an individual who was identified as an elected official of the locality. They exchanged a drink from a bottle, and then the visitor was sprayed with water, perfume, and a dust of white talc. The women shifted their dance routine to honor this guest as they chanted a special tune. Shortly after, they returned to the platform and resumed their dance.

The dance around the mapou tree involved turning, twisting, shoulder rolling movements, and various steps, while swinging a large skirt and singing, with two among the dancers shaking the cha-cha. The ensemble of women performing these movements uniformly created a beautiful scene, and their striking voices filled the space. The group leader blew his whistle and verbally requested the singers to raise their voices. Some of the women appeared to be tired and, for a brief time, slowed down. The event last approximately 90 minutes. The dance started close to 5:00 pm and ended before sunset but could have been prolonged. However, a "timeout" hand signal alerted the group leader to end the party, which was granted at the second request. The fourth song was the last, and the keyword in the final lyrics was "goodbye." The dancers extended their arms into the air at the sound of the beat and the whistle. The bystanders dispersed, as did the organizers, who boarded the bus to return to their hometown. The planners did not seek to obtain a municipal permit for the occasion; the landowner's approval sufficed for the dance to take place on the property. The same endorsement was valid for collecting soil samples around the silk cotton tree.

Soil Sample Testing

The purpose for conducting soil analysis was to identify the contents of the dirt that sustains the giant trees and ensure any cultural relevance. The soil sampling results were similar in many aspects between the species, while different in others relative to their contents. The laboratory used hydrometer, colorimetric, and Mechlich 1 methods for soil content analysis. The results are that, compared to Ceiba, the Ficus plot had a slightly higher percentage of sand and silt and a lower percentage of clay. It appeared that values are meaningless in the Haitian cultural standpoint as this information did not come up when gathering the data.

Table I: Soil Sample Testing Result of Silk Cotton and Ficus

Test	Method	Results and interpretation	
		Sample 1: Silk Cotton	Sample 2: Ficus
Texture	Hydrometric	Sand: 40% Silt: 37% Clay: 23% Silty	Sand: 46% Silt: 38% Clay: 16% Silty
pH	Mixing 1:2 v/v	6.89 Neutral	7.07 Neutral

Test	Method	Results and interpretation	
	Water/Soil		
C.E (dS/m)	Mixing 1:2 v/v Water/Soil	0.43 Average	1.126 Very High
MO	Colorimetric	Low	Very High
N-NH4 N-NO2 N-NO3	Colorimetric	12 Low <5 Very Low 30 Average	12 Very Low 5 Low 75 Excessive
P205 (ppm) K20 (ppm) Mg (ppm) Ca (ppm) $S04^{2}$- (ppm) Mn (ppm) Fe (ppm) Al	Mechlich 1	115 High 108 Average 50 Average 7000 Very High <50 Trace <2.5 Trace 2.5 Low 10 Low	180 Excessive 200 High 25 Low 7000 Very High <50 Trace <2.5 Trace 2.5 Low 10 Low
Cl-	Precipitation	<12.5 Trace	12.5 Very Low

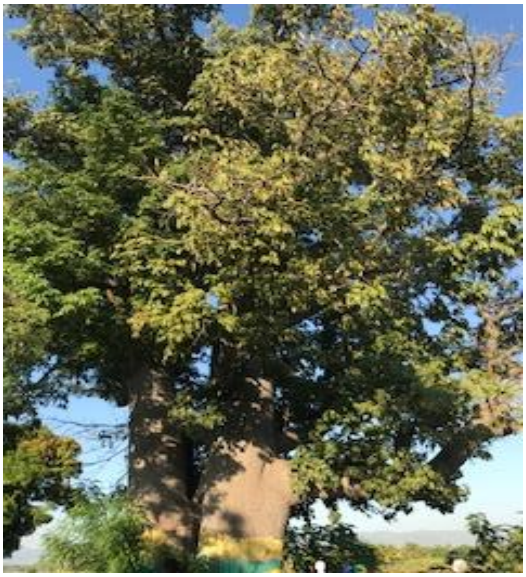

Fig 1: Top Section of Mapou tree in Grande Saline, Département de l'Artibonite

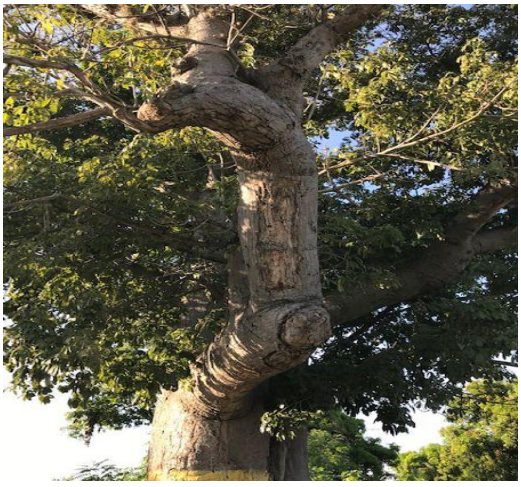

Fig 2: Middle Section of Mapou tree in Grande-Saline, Département de l'Artibonite

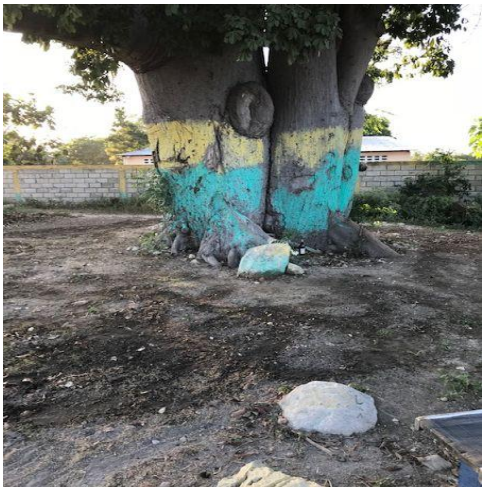

Fig 3: Lower Section of Mapou tree clean stage for the dance

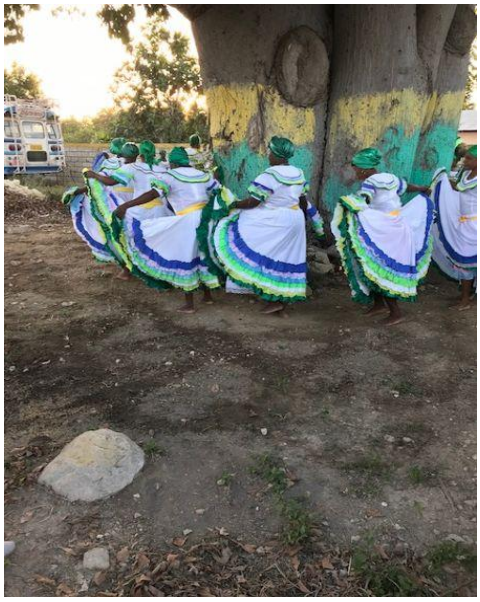

Fig 4: Dance around the Ceiba tree located at Grande-Saline, Department de l'Artibonite

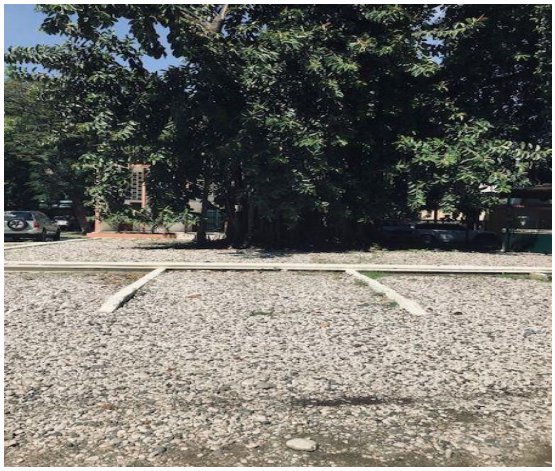

Fig 5: Healthy Ficus tree in the courtyard of the University of Agronomy, Port-au-Prince, Haiti

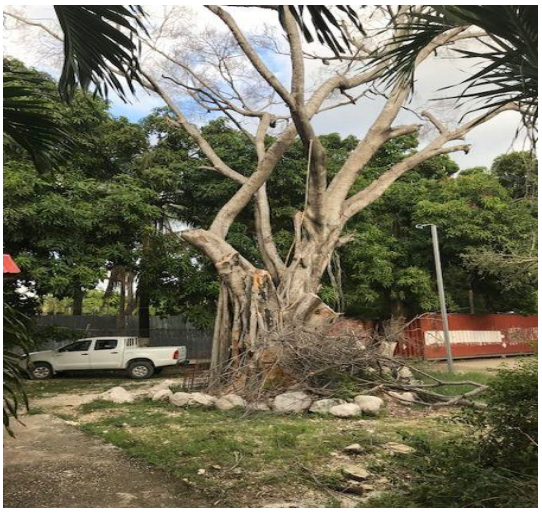

Fig 6: A dying Ficus tree at the University of Agronomy Port-au-Prince, Haiti

Fig 7: Ficus tree at Plasimond Habitation, located in Grande-Saline, Département de l'Ouest Port-au-Prince, Haïti

DISCUSSION

Tropical trees of massive dimensions have aroused significant curiosity and numerous investigations. How the Kapok and the Ficus species have adapted to reach gigantic proportions is one of the amazing facts with gratifying effect, while other trees do not reach this height. This qualitative study assessed the various attributes of Ceiba Pentandra and Ficus *thonningii* while examining the knowledge the Haitian people, the prospective agronomists, and the seniors in an American University possess as it relates to those species. Study of soil sampling did not lean to any irregularities. Observation of the dance around the Silk Cotton tree unveils an enduring respect and passion for the tree. The literature review was the source of a range of rich information, forming the core of the study. The findings obtained from the interviews suggested that the locals who participated in this study recognized the numerous values and the multiple benefits the Kapok and the Ficus provide relative to their medicinal and pharmaceutical properties as much as their various industrial advantages. They also possessed more knowledge about the attributes those flora have in treating various diseases unlike the students from the University of Agronomy in Haiti who lacked insight regarding that information.

There is still plenty for the natives to learn about the usage and the qualities of those species and their roles in the environment. Adding to their awareness can only enrich their understanding about those trees. What the locals and the Haitian university students have in common is their cultural awareness regarding these florae. They share the same cultural beliefs and both groups reported similar experiences. This topic was foreign to the scholars in the American university. However, the few of Haitian ethnic background could relate to the same cultural beliefs as the participants in Haiti. Regardless of whether one lives in Haiti or overseas, the cultural sentiments towards those species are similar. This common denominator could serve as a pedestal for divulging the array of documented scholarly information available on those species, speaking of their pharmacological, medicinal, and industrial values. This conventional platform could be used as an opportunity to expose the data available about the flora and can be a positive learning experience to benefit all. This is surely a venue to reinforce and supplement knowledge while concurrently preparing the nationals to handle constructive debates on the subject matters.

Furnishing scholarly content on those species regarding their attributes can address the topic partially. Dealing with the cultural beliefs of the natives regarding the spirits residing in those trees is another issue that deserves a different type of attention. The literature relevant to those data is lacking. However, we cannot dismiss convincible alternatives data that realistically can be supported. This will entail a dive into the reservoir of longstanding cultural norms that have grounds in intergenerational traditions; this can be a complicated task to approach, but not an impossible one. In response to the second question that framed this

research, changing or altering the beliefs of the natives presents some challenges. This comes with consequences. Transforming content embedded in culture is not an easy fix because it is how one views reality about self, others, and things. Culture represents different emotions for people. Spencer-Oatey (2012) highlighted some of the most prominent interpretations about culture, a topic vast enough to require its own continuing line of inquiry. However, regardless of its various meanings, one should be cautious when making changes in culture because doing so can activate personal emotions and feelings. Smollan and Sayers (2009) found this to happen in organizations that are making changes in their cultural functioning. Considering that this can occur in a controlled environment, one can imagine how it will be in a society and in a country like Haiti. Therefore, a sincere effort to prevent the rise of undesirable emotions must be deployed. This can be done with strong leadership involving people who have impact in the community such as activists, political officials, religious figures, and business leaders. Any attempts to addressing traditional norms must be supported and reinforced with the laws. Legislators and policy makers are usually influential during any transitional process and their input will be worthwhile. Although these impacts need not be negative, an evolutionary stance could be the onset to positive outcomes. Asserting the impact of social media, technology, and education to enlighten the natives regarding the qualities of those species is not a cause in vain. However, this effort is two-sided. One is to propagate existing scholarly content. The second is to convert the cultural beliefs into sound data and divulge those results to obtain cultural change.

One of the fundamental points made by the participants of Haitian background is the phenomenon of dealing with the invisible spirits residing in those species and dominating the land where those trees are located. This pattern of invisibility and domination is also repeated in the findings relevant to fungi or precisely arbuscular mycorrhizal fungi (AMF). Fungi have been responsible for being strategically important in their roles in the planet relative to the ways people live, think, and behave. They are invisible. They intermingle in the soil and travel for miles (Sheldrake, 2020). As for AMF, they are responsible for exchanging carbon and facilitating its storage in the soil (Birhane *et al*., 2020). AMF obtained from higher biomass of fine roots are involved in this activity. Simard (2008) believed this exchange between trees is made possible through mycorrhizal networks formed with nodes linked to others nodes which allow a form of systemic communication, where chemical signals occur, and resources are shared.

It is also assumed that there is a form of communication propagated in a network with a set of operations that continuously produces new ones in a process called autopoiesis, which explains how Haitian cultural beliefs regarding those species are circulated throughout generations. It makes sense to simulate an approach to understand why Haitians' beliefs are framed in that fashion, relative to Ceiba and Ficus. Their cultural views are shaped under some linguistic (L) repetitive patterns, which are guided in an environment by a set of networks that in turn produce some operations (O), through a process known as autopoiesis (A), that all takes place in a system (S). In the present study, this process called L.O.A.S. is to reflect the guidelines of the general system theory conceptualized by Luhmann (2013). The notion L.O.A.S. seems to clarify the persistence of Haitian cultural beliefs regarding the tropical species of Ceiba and Ficus. The term "loas" is familiar to the folk when relating to those spirits. Framing those beliefs within a constructive concept such as autopoiesis is a chance to break through those rigid barriers that for so long trapped the mentality of the people. The formation of data based on the content derived from the study of fungi along with the autopoiesis framework selected for this study are a reasonable approach when proposing to change those traditional beliefs to more productive, effective, and evolutionary norms.

CONCLUSION

Ceiba and Ficus are well-known botanical species in Haiti. A myriad of studies conducted on those flora provide supportive literature of their usefulness in treating disease and in several other industries. Haitians regard those arboreal genera and believe they are spirit loci. They value them as a dormitory for the unseen, believing the impressiveness of their height, large canopy, huge stems, and deep invasive roots must serve as purposeful mystical markers. However, they are not able to buttress such beliefs with scholarly evidence. Haitians believe in holistic treatment, yet despite the numerous medicinal, pharmaceutical, and industrial attributes associated with those species, they embrace their cultural viewpoints rather than focusing on other contributions those trees could offer. Therefore, it is appropriate to propose an evolutionary approach as a qualifiable venue to convert those beliefs to obtain positive outcomes.

The ideal interventions to transform those beliefs into better practice are the promotion of education in the form of workshops, lectures, presentations, displays, and short virtual or in-person courses. Community engagement to foster multipurpose activities is a rewarding approach to stimulate interest and foster participation in debates relevant to social change. Competent leadership is key to this effect. An impressive and contributory approach will be the input of higher and secondary education institutions in developing courses on those topics for enlightening the locals and propagating knowledge. The appropriation of informative and social media networks can serve as a

perfect portal for providing sound communication. Online and print resources are beneficial to all, in addition to being a durable literary asset. Television programming purposely designed is a useful tool to expose this topic. Ongoing research on the topic is a favorable avenue, as it is necessary to inquire about the sources or causes generating and tolerating a systemic autopoietic operational platform. Moreover, this could destabilize a pattern that is more destructive than promulgating social productivity, which is a much-needed solution for native Haitians.

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