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Biodiversity and environmental impacts in Mata da Cafurna, municipality of Palmeira dos Índios, Alagoas

A biodiversidade e os impactos ambientais na Mata da Cafurna, município de Palmeira dos Índios, Alagoas

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A B S T R A C T

Palmeiras dos Índios, in the state of Alagoas, is home to a rich biodiversity in the Mata da Cafurna village, as well as about 150 indigenous families of the Xukuru-Kariri people. The present study has environmental importance, as it will emphasize the little-known fauna and flora and present anthropogenic interferences, contributing to a greater awareness in the sustainable use of natural resources. The purpose of this work is to investigate, through literature research, the biological diversity in the Mata da Cafurna and the possible environmental impacts caused by farmers or people outside the village. Compiling data from scientific works carried out in the last ten years, it was possible to produce a list containing 39 species of plants, among the best known are the *murici* (*Byrsonima crassifolia*), *jatobá* (*Hymenaea courbaril*), *jurema* (*Acacia jurema*), *barbatimão* (*Stryphnodendron coriaceum*) and juá (*Ziziphus joazeiro*). Among the vertebrates identified are the paca (*Cuniculus paca*), the maned (*Chrysocyon brachyurus*), the anteater (*Myrmecophaga tridactyla*), and the deer (*Mazama spp.*). These species correspond to a number certainly lower than the number existing in the village, since few scientific studies have been produced in the area studied. It has been found that fragmentation, deforestation for agriculture, irrational use of natural resources and hunting of animals alter the landscape thus becoming a threat to biodiversity.

R E S U M O

Palmeiras dos Índios, estado de Alagoas, abriga uma rica biodiversidade na aldeia Mata da Cafurna, além de cerca de 150 famílias indígenas do povo Xukuru-Kariri. O presente estudo possui importância ambiental, pois dará ênfase à fauna e flora pouco conhecida e apresentará as interferências antrópicas contribuindo para uma maior conscientização no uso sustentável dos recursos naturais. A proposta deste trabalho é investigar através de pesquisas na literatura, a diversidade biológica na Mata da Cafurna e os possíveis impactos ambientais causados por agricultores ou pessoas externas à aldeia. Compilando dados de trabalhos científicos realizados nos últimos dez anos, foi possível a produção de uma lista contendo 39 espécies de plantas, entre as mais conhecidas estão o murici (*Byrsonima crassifolia*), a jatobá (*Hymenaea courbaril*), a jurema *(Acacia jurema*), o barbatimão (*Stryphnodendron coriaceum*) e o juá (*Ziziphus joazeiro*). Dentre os vertebrados identificados destacam-se a paca (*Cuniculus paca*), o guará (*Chrysocyon brachyurus*), o tamanduá (*Myrmecophaga tridactyla*), e o veado (*Mazama* spp.). Essas espécies correspondem a um número certamente inferior à quantidade existente na aldeia, pois foram produzidos poucos trabalhos científicos da área estudada. Verificou-se que a fragmentação, o desmatamento para agricultura, o uso irracional dos recursos naturais e a caça de animais alteram a paisagem tornando-se assim uma ameaça para a biodiversidade.

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Introduction

"The state of Alagoas is located in the Northeast region of Brazil" (Barros, Araújo-Filho, Silva & Santiago, 2012), its natural geographic space is formed by predominant elements of each region, such as relief, climate, vegetation and hydrography. In the more arid portion, the Caatinga scenario prevails, "characterized by a type of xeromorphic vegetation" (Coe & Gomes, 2015), while in the agreste, the remnants of the Atlantic Forest predominate.

Palmeira dos Índios is the fourth largest city in the State of Alagoas, its name was given "in reference to the first inhabitants and the abundance of palm trees in its fields" (Santos & Bezerra, 2020). The municipality has a privileged geographical location for being a climate transition zone with the agreste and the hinterland of Alagoas.

In its mountains there are formations where small farmers and the indigenous community Mata da Cafurna live, which we will emphasize in this work. The Xukuru-Kariri people collect materials from Mata da Cafurna for the manufacture of handicrafts, which are a source of income for the indigenous people. It is important to highlight that there is a concern with the removal of natural resources, in ways that do not cause damage to the ecosystem.

The forest (Mata) is one of the few native areas in the municipality, presenting characteristics of the Atlantic Forest, but predominating the Caatinga inserted in a *Brejo de Altitude*, marked by its humidity in all seasons of the year. It serves as a shelter for animals, birds and lush trees with many species not yet catalogued (Silva, 2019).

Also according to Silva (2019), "because it has these characteristics, the area is widely coveted by farmers who want to expand their herds and consequently profits, especially because it is a region with abundant water and several springs". For this reason, it has been a decades-long dispute to officialize and demarcate the Mata da Cafurna as belonging to the Xukuru-Kariri indigenous community (Ministério Público Federal, 2023).

Thus, the objective of this work was to investigate, through literature research, the biological diversity in the Mata da Cafurna and the possible environmental impacts caused by farmers or people outside the village. The present study will emphasize the little-known fauna and flora and present the anthropogenic interferences, contributing to a greater awareness in the sustainable use of natural resources.

Material and methods

Mata da Cafurna belongs to the municipality of Palmeira dos Índios, in the interior of Alagoas, and is located at the coordinates: 759842.00 m E longitude and 8962418.00 m S latitude. According to Peixoto (2013, p. 53) the place "is located six (06) km from the city headquarters" and access by car or motorcycle is not always possible, depending on the

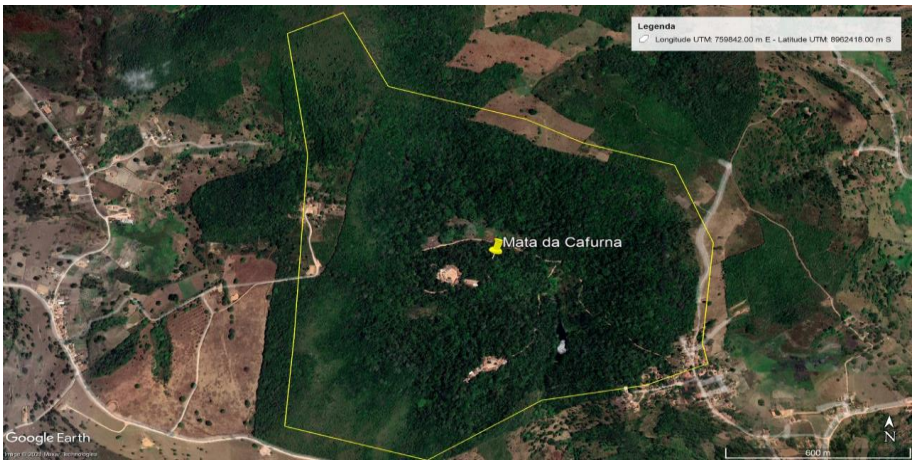
weather conditions and the situation of the roads, in the rainy season the route can take place on foot.

Retaken in 1979 after a long legal process, the area of the aforementioned village "is territorially composed of 620.6 ha, is inhabited by about 150 families, an average of 812 indigenous people" (Neves, 2019) of the Xukuru-Kariri people. According to Neves (2019), the highest point in the village is Serra Pelada, "for the indigenous [...] Serra exceeds the altitude of 350 m at sea level".

The territory has a semi-humid tropical climate, with hot summers and reasonably cold winters, the rainy season is concentrated between the months of May and August. The ecosystem in question has variations of the Caatinga and Atlantic Forest biomes, even though it is part of the semi-arid region of Alagoas, known for the various perimeters of dry areas.

Figure 1.

Marking of the territory of Aldeia Mata da Cafurna, Palmeira dos Índios, Alagoas.



For the construction of this Systematic Review, a bibliographic research was initially carried out, for which the following keywords were used: Mata da Cafurna, Fragmentation, Atlantic Forest, Caatinga, Biodiversity, Palm Tree of the Indians and Xukuru-kariri Indigenous Peoples.

Scientific websites such as Google Scholar, the Institutional Repository of the Federal University of Alagoas (*Universidade Federal de Alagoas*), the Institutional Repository of the Federal University of Paraíba (*Universidade Federal da Paraíba*), the Embrapa website and the Online Collection of the Federal University of the State of Rio de Janeiro (*Universidade Federal do Rio de Janeiro*) (Herbario Huni) were used. Scientific publications such as "Ciência Florestal", "Biodiversidade Brasileira", "Revista Brasileira de Geografia Física", "Revista Valore", among others, were also accessed.

Among the academic studies that most pointed out data and priority for research, the following stood out:

- The master's dissertation entitled “The Xukuru-Kariri Indians in the Mata da Cafurna, in Palmeira dos Índios: Socio-environmental relations in the semi-arid region of Alagoas (1979 to 2016)”, by the author Mary Hellen Lima das Neves;
- The dissertation “Indigenous protagonism in Palmeira dos Índios (1979-2013)” (2019), by the author Amanda Maria Antero Silva;
- The dissertation “Memories and Images in Confrontation: The Xukuru-Kariri in the collections of Luiz Torres and Lenoir Tibiriçá” by the author José Adelson Lopes Peixoto (2013);
- The article “The Toré of the Xukuru-Kariri: Identity and religious self-affirmation in Palmeira dos Índios de Alagoas”, published in Ouricuri Magazine (2020).

In addition, the use of aerial photographs obtained through Google Earth strengthened the narratives and descriptions of the village space, making it possible to relate the text to the images.

Results and discussion

The Mata da Cafurna village corresponds to a remnant fragment of the Caatinga and Atlantic Forest biomes, that is, an “area of continuous natural vegetation, interrupted by anthropogenic barriers” (Peixe, Torres, 2011) such as roads, cities, agricultural crops, pastures, etc.

> “People destroy or damage natural ecosystems for the sake of agricultural, urban and industrial development” (Townsend, Begon, Harper, 2010, p. 475). Thus, “when large, continuous areas of habitats are broken down into smaller fragments, the resulting loss of habitat area typically causes a reduction in biodiversity” (Ricklefs, 2010, p. 482).

According to Cardoso (2016, p. 451), fragmentation “not only causes the extinction of species and the reduction of biodiversity, but also the elimination of ecosystems, populations, genetic variability, and the ecological and evolutionary processes that maintain this diversity”. In addition, species living along the edges of the fragments can be negatively affected by “solar radiation and air and soil temperature” (Blumefeld, Santos, Thomaziello & Ragazzi., 2016, p. 1302).

The vegetation of the Mata da Cafurna stands out for the high number of species, with the predominance of angiosperms, this group is characterized by presenting flowers and fruits, in addition to the diversity in relation to size, habit and occupation of habitats. Little is known about the species of the Mata (forest) due to the small number of studies carried out. By compiling data from scientific works such as master's dissertations carried out in the last ten years, it was possible to produce a list containing 39 species of plants, among the best known are *murici* (*Byrsonima crassifolia*), *jatobá* (*Hymenaea courbaril*), *jurema* (*Acacia jurema*), *barbatimão* (*Stryphnodendron coriaceum*), *amescla* (*Protium heptaphyllum*) and *juá* (*Ziziphus joazeiro*).

Table 1:

Plant Species identified in the Mata da Cafurna, Palmeira dos Índios, Alagoas

Note: Survey data (2021).

Taxonomy	**Popular name**	**Habitat**
Aloe vera	Aloe vera	Exotic
Anacardiaceae	Aroeira	Native
Anacardimum	Cashew tree	Native
Arrabidaea agnus-castus	Cipó rego	Native
Artocarpus heterophyllus	Jackfruit tree	Exotic
Bignoniaceae	Ipê	Native
Byrsonima crassifólia	Murici	Native
Cappris flexuosa L.	Feijão-bravo	Native
Cecropia	Embaúba	Native
Cupania vernalis	Caboatã	Native
Cymbopogon citratus	Holy grass	Exotic
Dysphania ambrosioides	Mastruz	Native
Eucalyptus	Eucalyptus	Exotic
Goupia glabra AubI.	Cupiúba	Native
Hymenaea courbaril	Jatobá	Native
Hyptis pectinata	Sambacaitá	Native
Ingá	Ingazeira	Native
Laurus nobilis	Louro	Native
Mangifera	Hose	Exotic
Melissa officinalis	Lemon balm	Exotic
Mentha x piperita	Small mint	Exotic
Mimosa ophthalmocentra M.	Jurema de imbira	Native
Musa	Banana tree	Exotic
Ocimum gratissimum	Alfavaca	Exotic
Palmae	Cipó titara	Native
Passiflora edulis	Passion fruit tree	Native
Pithecolobium polycephalum Benth	Canzenzo	Native
Persea americana	Avocado tree	Exotic
Protium heptaphyllum	Amescla	Native
Psdium guajajara	Guava tree	Exotic
Pterodon	Sucupira	Native
Rosmarinus officinalis	Rosemary	Exotic
Scoparia dulcis L.	Vassourinha de botão	Native
Stryphnodendron coriaceum	Barbatimão	Native
Syagrus cearenses	Catolé	Native

Syagrus coronata	Ouricuri	Native
Talisia esculenta	Pitomba	Native
Tapirira guianensis	Pau pombo	Native
Ziziphus joazeiro	Juá	Native

Of the 39 species of flora identified in the Mata da Cafurna, 27 are native to the Caatinga and Atlantic Forest, while 12 species are exotic such as aloe vera (*Aloe vera*), small mint (*Mentha x piperita*), *alfavaca* (*Ocimum gratissimum*) and rosemary (*Rosmarinus officinalis*).

According to Sampaio and Schmidt (2013, p. 33) "since the beginning of agriculture, species from practically all taxonomic groups have been transported by humans beyond the natural barriers that delimited their original distribution". This transport of species took on a global scale after the beginning of the great navigations around the world, since then, it has been occurring for the most diverse reasons, mainly for food production, commercial uses, landscaping and even for environmental purposes.

Once established, the species may not be able to reproduce or disperse beyond the place of introduction, and thus not cause harm to the environment. Therefore, many introduced species need human care and remain restricted to places such as gardens, vegetable gardens, or backyards.

The literature found did not mention environmental impacts caused by the intentional introduction of five of the non-endemic species identified in the Mata da Cafurna:

- *Aloe vera* or *babosa* "is a xerophytic plant, originally from North Africa and the Middle East" (Cordeiro, 2020), this species has been cultivated because it has therapeutic, cosmetic, homeopathic and nutritional properties, widely disseminated by traditional medicine and with several proven pharmaco-biological properties.
- Lemon balm (*Melissa officinalis*), "belongs to the Lamiaceae family, of Asian and European origin, has been cultivated in Brazil for more than a century" (Souza et al., 2012, p. 1516), its leaves or branches are used as a sedative in headaches, flu-like conditions, palpitations, gastrointestinal and menstrual disorders, as well as in rheumatism.
- Small mint or pepper mint (*Mentha x piperita*) it is endemic to Europe and was brought to Brazil during the colonization period. "It is a medicinal plant that has been used for thousands of years due to its various aromatic and medicinal properties, which have made it one of the most sought-after odorous plants on the planet" (Fernandes, 2018, p. 11).
- The species *Ocimum gratissimum* known as *alfavaca*, basil, *alfavacão*, *alfavaca-cravo*, *favacão* and *quioio-cravo* "it is an aromatic subshrub up to 1 m tall, native to Asia and Africa" (Souza et al., 2011, p. 297).

- "*Rosmarinus officinalis L.,* popularly called rosemary, is a plant species native to the Mediterranean region" (Oliveira, Veiga, 2019, p. 2), in Brazil it is widely used in food, mainly in the form of a seasoning, being responsible for adding flavor to dishes and pleasing different palates.

On the other hand, exotic plant species can interact negatively with native plants due to resource competition, space occupation, cover growth and chemical inhibition due to the release of toxic substances by roots, leaves and seeds - allelopathy. In circumstances where environmental conditions favor the exotic, this dispute can intensify and cause a depressive effect on the natives, excluding them from the site.

In the case of jackfruit tree, *Artocarpus heterophyllus*, this species has its origin in the tropical forests of India, but was introduced in Brazil during the Colonial period and adapted very well to the environmental conditions of the country. Currently this species is invasive in areas of the Atlantic Forest, a single adult plant can produce more than 100 fruits per year, each one having up to 500 seeds, with a germination rate of approximately 90%.

According to Santos (2013, p. 22) "some studies have shown possible effects of jackfruit trees on native Brazilian plant species, which may cause species exclusion". Other studies have shown a negative effect through allelopathy for the development of plants growing on substrates with extracts of different parts such as leaves, stems and fruits. In addition, "data indicated that in forest areas under the presence of *Artocarpus heterophyllus* there was a considerable reduction in amphibian abundance" (Santos, 2013, p. 60). This is indicative that the presence of jackfruit potentially alters the environment by reducing favorable habitats for these anurans.

The holy grass, also known as *capim-limão*, *capim-cidreira*, *capim-catinga*, *capim-cheiro* it is also a plant native to India that found in Brazil favorable climatic conditions for its development. The work of Melhorança Filho et al. (2012, p. 21) revealed that "this plant species is perennial, forms dense and vigorous clumps of up to 1.2 meters in height with underground rhizome", which are characteristics similar to those of aggressive and problematic invasive plants. Also according to the author, the effects of *Cymbopogon citratus* can occur "by the release of phytotoxins, [...] competition for light, water, and nutrients, which this plant species will establish" (Melhorança Filho et al., 2012, p. 26).

Regarding the "*Eucalyptus* genus originates from Australia, Tasmania and other islands in Oceania" (Embrapa, 2019) and there is no exact date of its introduction in Brazil. One of the environmental impacts generated by its cultivation is a possible drying out of the soil. Vechi and Magalhães Júnior (2018, p. 499) point out that this species "causes desertification, as it demands a large amount of water, removes nutrients from the soil and does not replace them, and deposits chemical substances that harm the reorganization of the ecosystem" and make it impossible for native animals to decompose and consume its leaves, thus accumulating on the soil.

Another factor of environmental impact is perceived in the alteration of water quality caused by chemical substances present in eucalyptus leaves, which are carried to the riverbeds. These leaves contain essential oils that contaminate the water and influence aquatic life (Vechi, Magalhães Júnior, 2018, p. 499).

It is not possible to indicate with precision the origin of the banana tree, as it is lost in Greek and Indian mythology, but it is currently admitted that its origin is Asian. The species of the *genus Musa* form large and dense clusters, preventing the establishment and development of other species due to excessive shading. In the long term, the species can dominate the understory of the forest and prevent natural regeneration (Leão et al., 3011, p. 54).

The *Mangifera genus* originates from Asia, was brought to Brazil by the Portuguese, becoming one of the main fruit trees cultivated in the Northeast. Mango trees "prevent the growth of other plants by allelopathy of fallen leaves" (Horowitz, Martins, Machado, 2007, p. 22). In addition, "subpopulations become dense, by spontaneous colonization, in forest environments" (Horowitz, Martins, Machado, 2007, p. 22). It is evident that medium/large vertebrates, omnivores and herbivores, are determinants in seed dispersal, so several seedlings still with cotyledons can be found meters away from the mother plant.

The avocado tree (*Pressa americana*) is a plant native to Mexico and some regions of South America, its introduction was carried out due to the importance of its fruits, much appreciated as human food. Although this introduction was carried out with good intentions, this species became invasive and its "negative impact outweighed such benefits, as its presence [...] is due to anthropic interference, resulting in aggression and alteration of the natural characteristics of this ecosystem" (Sauthier et al., 2014).

The knowledge about the origin of the guava tree (*Psiduim guajajara*) is still uncertain and, therefore, it is considered exotic in Brazil, being consumed and dispersed mainly by birds, monkeys, lizards, fish and ants. This plant invades areas at different levels of disturbance and forms dense clumps, eliminating native vegetation and exerting its dominance (Leão et al., 2011, p. 57).

Table 2 presents a list of only 15 species of fauna containing birds, mammals, reptiles, and fish. It was possible to observe that the bibliographies that deal with the local fauna are rare. Among the vertebrates identified, the paca (*Cuniculus paca*), the maned (*Chrysocyon brachyurus*), the anteater (*Myrmecophaga tridactyla*), and the deer stand out (*Mazama spp.*).

Table 2.

Animals identified in the Mata da Cafurna, Palmeira dos Índios, Alagoas.

Name or Scientific Classification	Popular name	Habitat
Ardeidae	Heron	Native
Chrysocyon brachyurus	Guará	Native
Cichlidae	Tilápia	Exotic
Colossoma macropomum	Tambaqui	Exotic
Cuniculus paca	Paca	Native
Dasipodídeos	Armadillo	Native
Elapidae	Coral snake	Native
Euphonia violácea	Guriatã	Native
Gallinula chloropus	Galinha d'água	Native
Mazama spp.	Deer	Native
Myrmecophaga tridactyla	Anteater	Native
Philodryas nattereri	Cobra corre campo	Native
Spilotes pullatus	Cobra canina	Native
Turdus rufiventris	Sabiá	Native
Viperidae	Rattlesnake	Native

Note: Survey data (2021)

Of the 15 species identified in the literature of Mata da Cafurna, 13 are endemic species of the Caatinga and/or Atlantic Forest, while the tambaqui (*Colossoma macropomum*) is native to the Amazon Basin and the tilapia (*Cichlidae family*) is native to the African continent.

An invasive fish can compete for food and space with other fish, as well as modify the weir environment, introduce new diseases, cause a mixture of species (hybridization) and the homogenization of fish species. In the worst situation, the invasive fish can even cause the local extinction of native fish, leaving the fisherman, the people and the reservoir only the fish that came from outside (Levis, Ramos & Lima, 2013). Another preponderant factor when there is the presence of exotic species is the possibility of imbalance of food webs and alteration of habitats, and thus causing the extinction of native species. The presence of invasive alien species represents an obstacle to the conservation of native species and natural resources.

The tambaqui (*Colossoma macropomum*) is an exotic species with high power of invasion and destructuring of aquatic ecosystems, this species was voluntarily introduced in several lakes and dams in the Northeast for use in aquaculture. Among its main effects are “predation and competition with native species of different groups, causing a reduction in biodiversity” (Leão, Almeida, Dechoum & Ziller, 2011).

Tilapia, in turn, compete with native species for food and space, in addition, “they dislodge other fish due to the aggressiveness with which they defend their nests” (Levis,

Ramos& Lima, 2013, p. 52). These traits cause a low mortality rate of their young, due to parental care and the success of this group of fish.

In general, animals are of fundamental importance in the maintenance of natural ecosystems, as they control populations, disperse seeds and can also pollinate flowers of some plants. However, "wildlife has been greatly threatened by subsistence hunting and illegal trade" (Fonseca, 2017, p. 3).

In this way, the retaking of the Mata (forest) by the Xukuru-Kariri was of great importance because it was possible to take care of the environment, "hold what it had" from animals such as *paca*, deer, snakes, birds, birds, as well as thinking about reforestation or at least actions that minimize the damage to Nature. "Since then, there have been IMA actions in the Village with the release of recovered animals so that it is possible to reintegrate them into the natural environment, in addition to inspections against hunting and deforestation" (Neves, 2019, p. 70).

Final considerations

Mata da Cafurna corresponds to a forest fragment rich in endemic species of the Caatinga and Atlantic Forest Biomes. According to the research, about 39 species of flora and 15 species of fauna were identified, including birds, reptiles, freshwater fish and mammals. These species correspond to a number certainly lower than the number existing in the village, since few scientific studies have been produced in the area studied. More investigative work is needed in the Mata da Cafurna to obtain more robust information on biodiversity.

Human activities, such as deforestation for agriculture, construction, and the irrational use of natural resources, have been found to alter the landscape thus becoming a threat to biodiversity. According to the visualization of the map using Google Earth, the Mata da Cafurna is surrounded by agricultural plantations, urbanization and road. In addition, the conflict between the indigenous peoples of the village and farmers in the region has promoted uncertainties regarding the conservation of local biodiversity. With this, it is believed that the demarcation of the indigenous lands of the region will be the first step towards the identification and conservation of the animal and plant species of the Mata da Cafurna. Secondly, the inclusion of social projects and ecotourism, in order to improve the quality of life and financial quality of the indigenous people.

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