



Caipora and the conservation of natural resources in tropical forests in the South Recôncavo region, Bahia State, Northeast Brazil

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ABSTRACT

This study aimed to investigate the relationship between the imaginary of Caipora and environmental conservation in Serra da Jiboia. Data obtained through the application of semi-structured interviews and Likert scale. All data were analyzed qualitatively and quantitatively. Interviews were carried out with a total of 57 residents, adult men and women whose main source of income is provided by agricultural activities. Through factor analysis, it was possible to identify four factors that explain the variations in responses given by residents of the region, suggesting a strong belief in the spiritual entities of the forest and its importance for nature conservation. Although Catholicism is the predominant religion in the region, belief in Caipora was high, being related to the appreciation and preservation of local nature. Through the chi-square test, it was possible to verify a statistically significant relationship between the belief in Caipora and the activities carried out in the forest by the interviewees. This study contributes to the understanding of the relationship between popular beliefs and environmental conservation, highlighting the importance of considering local knowledge for the development of public policies aimed at nature preservation.

Keywords: Serra da Jiboia, popular beliefs, nature spirits, enchanted beings..

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RESUMO

Este estudo teve como objetivo investigar a relação entre o imaginário da Caipora e a conservação ambiental na Serra da Jiboia, Bahia. Os dados, obtidos por meio da aplicação de entrevista semiestruturadas e Escala de Likert, foram analisados de forma qualitativa e quantitativa. Foram realizadas entrevistas a um total de 57 moradores, homens e mulheres adultos cuja principal fonte de renda é fornecida por atividades agrícolas. Por meio de análise fatorial, foi possível identificar quatro fatores que explicam as variações nas respostas dadas pelos moradores entrevistados, sugerindo uma forte crença nas entidades espirituais da mata e sua importância para a conservação da natureza. Embora o catolicismo seja a religião predominante na região, a crença na Caipora se mostrou elevada, sendo relacionada à valorização e conservação da natureza local. Através do teste de qui-quadrado, foi possível verificar uma relação estatisticamente significativa entre a crença na Caipora e as atividades realizadas na mata pelos entrevistados. Este estudo contribui para a compreensão das relações entre crenças populares e conservação ambiental, destacando a importância de considerar o conhecimento local para o desenvolvimento de políticas públicas voltadas à conservação da natureza.

Keywords: Serra da Jiboia, crenças populares, espíritos da natureza, encantados.

SIGNIFICANCE STATEMENT

Indigenous peoples and traditional communities, through their spiritualities and cosmoperceptions, have shown attitudes directly involved with the conservation of the natural space and its integral biological and abiotic elements. This study investigates how beliefs in spiritual entities can influence the relationships that residents of Serra da Jiboia, Bahia State, develop with nature. Believing in Caipora can be understood as a central element in the construction of a collective identity and in the promotion of conservation actions for the Serra da Jiboia region. In this regard, it is necessary to combine spirituality and ecology in order to understand and support local beliefs and, in turn, implement ecologically-based strategies for rational conservation of natural resources and maintenance of the rich biocultural heritage associated with them.

INTRODUCTION

The Atlantic Forest is one of the Brazilian biomes known for the richness of its biodiversity. Occupying approximately 0.8% of the earth's surface, its biota comprises about 5% of all vertebrate and plant species in the world (Paglia and Pinto 2010). Classified as the second largest tropical rainforest in South America and one of the 35 global biodiversity hotspots, the Atlantic Forest draws the world's attention to its conservation due to its composition and high degree of endemism in fauna and flora species (Galindo-Leal and Câmara 2003; Myers *et al.* 2000). It is one of the oldest vegetation covers in the country, dating back approximately 70,000 years (Leitão-Filho 1987).

Prior to the period of colonization of Brazilian territory by European conquerors, the vegetation cover of the Atlantic Forest occupied more than 1.3 million km^2 of the country, mainly in the coastal regions (Fundação SOS Mata Atlântica 2020). Territorial occupation, resource extraction and development of hu-

man activities caused its degradation and reduction, leaving only 12% of remaining stretches (Lagos *et al.* 2007; Moreira 2018; Cardoso Nascimento and Landim Dominguez 2010; Paglia and Pinto 2010). Presently, areas belonging to the Atlantic Forest currently house 72% of the Brazilian population, provide 70% of the national GDP, and are home to three of the largest cities in South America (Fundação SOS Mata Atlântica 2020).

The Atlantic Forest biome is distributed in eight biogeographical sub-regions. The sub-region of Bahia covers 120,954 km^2 and extends from Sergipe to Espírito Santo, including part of the so-called Central Corridor of the Atlantic Forest (Silva and Casteleti 2003). Among the existing remnants in the state of Bahia, the area known as Serra da Jiboia stands out. This is a massif of hills of approximately 22,000 ha located approximately 100 km West of Baía de Todos os Santos, close to the Paraguaçu River Valley, between the inland and pre-coastal tablelands (SEI, 2003). Located to the north of the Central Atlantic Forest corri-

dor in the state, Serra da Jiboia serves as a transition zone between the Atlantic Forest and the Caatinga. Its vegetation cover plays a fundamental role in maintaining this central corridor, sheltering endemic and endangered species, in addition to the formation of three hydrographic basins: Jacutinga, Jaguaripe and Dona's River (Grupo Ambientalista da Bahia 2015; Souza 2018).

Despite its ecological importance, there has been very little public power action directed at the Serra da Jiboia region with regard to activities aimed at the conservation of the Atlantic Forest, counting only on the Guarirú Natural Heritage Private Reserve (RPPN Guarirú), in the municipality of Varzedo, as a Conservation Unit. This is a worrying factor that calls the attention of ecological groups and researchers about threats to local biodiversity. In recent years, reports of environmental harm made by local residents and researchers from different institutions point to the expansion of fires, deforestation, cattle raising, monocultures, disorderly urban expansion, hunting and trafficking of wild animals, demonstrating the need for socio-environmental policies aimed at both recovery and conservation of existing natural resources in Serra da Jiboia and surrounding areas (Galvagne-Loss *et al.* 2014; Blengini *et al.* 2015; Oliveira *et al.* 2018; Sandes and Naidorf 2017; Sandes and Santos 2017).

Efforts to preserve biodiversity often clash with human needs, as much of the biodiversity is in places where native peoples have lived for many generations, using the environment's resources in ways that are often sustainable (Dawson *et al.* 2021). It is necessary to understand, respect and use the knowledge systems intrinsic to the community in order to guarantee an action that is socially, economically and ecologically safer (Keitumetse 2014). Throughout human history, different socio-environmental systems have developed local beliefs and ecological practices that are aligned with ensuring both the conservation of nature and the maintenance of the biocultural heritage linked to it. In this sense, several scholars have highlighted that indigenous peoples and traditional communities, through their spiritualities, have effectively managed and protected species of fauna, flora and fungi, as well as natural spaces for generations (Allison 2017; Fernandes-Pinto and Irving 2017).

As having an intimate relationship with nature, indigenous peoples and traditional communities throughout the world conjure the elements of their environments to the so-called "Enchanted Ones", spiritual beings with mystical powers that live at the bottom of rivers, creeks, inside forests etc., being holders of magical abilities and wisdom (Albuquerque and Faro 2012; Maués 2012; Silva 2014; Silva *et al.* 2019; Vieira 2012). Some of these nature spirits care for hunting and fishing resources by creating no-hunting and

no-fishing zones, while others have no specific task beyond harassing those who venture deep into the forest. Various enchanted beings inhabit trees; others adopt human form and punish those who commit excesses against the providence of nature, mistreat animals, destroy forests or penetrate sacred places without asking permission (Mathews 2009; Oliveira and Borges 2010; Smith 1983; Steinhart 1984). To obtain permission to access resources or protection against accidents when entering a forest or any other natural environment, offerings are made to the "owners of the bush" or "game masters", usually in the form of tobacco, small beads, flowers, incense, fruits, and various grains (Costa Neto *et al.* 2023).

There is a rich tradition on spiritual entities of nature, making it possible to discuss the central thesis of spiritual ecology which maintains that the reciprocal relationships between these etheric entities and human beings, arising from an animist and vitalist vision of Nature, represent an ideological shield preventing deforestation and social inequality caused by modern agriculture (Hoeffe 2009). In fact, having an ecological spirituality and believing in beings of nature with magical-spiritual powers, or respecting and venerating certain sacred places and elements, are attitudes directly involved with the conservation of the natural space and its integral biological and abiotic elements (Berkes 1999; Bortolamiol *et al.* 2018; Zent and Zent 2022). Understanding how indigenous peoples and traditional communities perceive and use the natural resources on which they depend can provide a basis for formulating appropriate policies for natural resources management that benefits them while preserving their cultural beliefs (Chunhabunyatip *et al.* 2018).

In Brazil, the enchanted creatures of nature such as Curupira and Caipora assume roles of agents in the internal management and support of natural assets, since the belief in their punishments and apparitions demarcate and specify the use of these resources (Costa Neto *et al.* 2023; Magalhães *et al.* 2014). Considering the hunting activity, this transcultural phenomenon is surrounded by symbolic elements, knowledge and rules that establish a unique relationship between culture and nature, which, according to Barros (2017), cannot be dissociated. These protective beings, which inhabit forests, bodies of water or specific points in nature (from another perspective, which inhabit different strata of particular worldviews), particularly protect species from exploratory hunting and fishing, or the natural space as a whole (Fernández-Llamazares and Virtanen 2020).

Considering that hunting activity in the Serra da Jiboia is a historical practice that is part of a cultural and cosmological context, where animal species are seen as important resources for subsistence, the

present study sought to investigate the residents' perception of the existence of spiritual entities and their roles in conserving the forest and its resources. By understanding how beliefs in enchanted beings can influence the relationships that residents of Serra da Jiboia develop with nature, local cosmoperception could be included in studies in order to build a more efficient management plan for the Serra da Jiboia region.

MATERIAL AND METHODS

Study area

Serra da Jiboia covers part of the territory of five municipalities that are part of the economic region of the Recôncavo Sul, in the State of Bahia, Brazil (approximate coordinates 12°51'S and 39°28'W). Stretching north-south, its top measures 26 km in length and the maximum elevation reaches around 820 m.s.l.m. It has a total area of around 5,928 ha (59.28 km²), calculated from the contour line of 480 m, which coincides with its base. It is distributed as follows among the different municipalities: Varzedo, with 1,828 ha or 31%; Santa Terezinha, with 1,624 ha or 27%; Elísio Medrado, with 1,200 ha or 21%; Castro Alves, with 1,144 ha or 19%; and São Miguel das Matas, with 132 ha or 2% (Tomasoni and Dias 2003) (Figure 1).

This mountainous massif is located in an ecotone zone, which gives it a great diversity of climates, reliefs, soils, vegetation and fauna. Located between the Atlantic Forest and Caatinga domains, it is one of the westernmost points of the Atlantic Forest of Bahia and one of the humid hillside forests located further north in the state. The top (North-South direction) marks the limit of climate change in the region, with a climate varying between humid tropical, further east and southeast, and semi-humid tropical, further west and northwest (Carvalho Sobrinho 2004; Tomasoni *et al.* 2004).

The average annual temperature is 22°C and the annual rainfall is 1,200 mm, with variations depending on altitude and sea conditions, with rains concentrated between April and July, directly contributing to the formation and maintenance of important springs. As continentality increases (westward), humidity and precipitation decrease, making the climate drier. This makes possible the gradual variation of the vegetation, which goes from the predominant dense rainforest in the East and Southeast of the mountain range, to the extensive areas of shrubby caatinga with palm trees in the West and Northwest, passing through a semi-deciduous seasonal forest and, in the summits, a vegetation of rupestrian field (Freitas and Moraes 2009; Queiroz *et al.* 1996).

The region is of extreme hydrographic importance,

as the sources of the Jaguaripe River and Dona's River are located there. On the other hand, several water courses coming from the mountain swell the basins of the Jiquiriçá River (middle and lower course) and the Paraguaçu River (lower course). All these four rivers, especially the last one, play a fundamental role in the socioeconomic, cultural and environmental system of more than 30 municipalities in this region of the state of Bahia (Grupo Ambientalista da Bahia 2015; Tomasoni and Dias 2003).

Despite this region being indicated as one of the 147 priority areas for the conservation of the Atlantic Forest biome, being classified as of extreme biological importance (MMA 1997), in recent years, reports made by local residents and researchers from different institutions (UFRB, UEFS, UNEB, UFBA), point to the expansion of deforestation, soil erosion, hunting and trafficking of wild animals and plants, demonstrating the need to implement socio-environmental policies for the conservation of existing natural resources (Grupo Ambientalista da Bahia 2015; Sandes and Santos 2017).

Ethical aspects

This research was approved by the Human Research Ethics Committee of the State University of Feira de Santana (CAAE No. 47561321.8.0000.0053). Data collection took place from September 2021 to August 2022, visiting residents in the communities of Pedra Branca, Tucaia, Engenho, Cercadinho and Tabuleiro. Among the five municipalities that make up the Serra da Jiboia region, the interviews were carried out in communities located in Santa Terezinha, Castro Alves and Elísio Medrado. The selected participants had connections with forest areas for recreational or exploratory purposes. Respondents signed the Free and Informed Consent Form (TCLE) in accordance with ethical and legal obligations (National Health Council, Resolution No. 466/2012).

Collection of ethnoecological data

Data collection took place from September 2021 to August 2022, based on ethnographic techniques already outlined in the literature (Barbosa 2007; Bernard 2006). The Informed Consent Form was read, explained and signed by residents at the beginning of each interview. Open interviews (free conversations) and semi-structured interviews (based on a list of previously chosen topics) were applied, as well as through ad libitum behavioral observations, resorting to the usual techniques of ethnographic recording. The questions contained in the semi-structured interview were centered on socioeconomic data, religious practices, myths and extractive activities.



Figura 1. Location of Serra da Jiboia in the Recôncavo Sul region in the State of Bahia, Brazil. Source: <http://www.sei.ba.gov.br>

All interviews were carried out with those participants who had a direct connection with the forest areas, such as hunters, firewood collectors and other groups that perform some extractive activity, as well as with those individuals who entered the forest for recreational, tourist or other purposes. Photographs, recordings and field notes were taken only when authorized by the interviewees, with the purpose of complementing data.

The “snow ball” model (Vinuto 2014) was used for the selection of respondents, where an initial respondent indicated other participants and so on, creating a web of information. Due to the COVID-19 pandemic, the interviews followed the safety protocols determined by the World Health Organization (WHO), Pan American Health Organization (PAHO) and the Bra-

zilian Ministry of Health.

Residents’ perception and attitudes towards spiritual entities were measured using the Multiple Weighting Questionnaire - Likert Scale (Likert 1932), adapting it to the research in question. The scale consisted of three points: strongly disagree, indifferent and strongly agree. Attitudes were considered negative when the interviewee showed disbelief and conflicts with enchanted beings; positive, when the interviewee believed in the enchanted ones and their protective actions; neutral attitudes are when the respondent’s response showed indifference to the existence of such spiritual beings.

All material collected will be kept at the Laboratory of Ethnobiology and Ethnoecology/UEFS for a period of five years for evidentiary purposes and will

be discarded after that period.

Data analysis

The controls were carried out through tests to verify the consistency and validity of the responses, using synchronic and diachronic interviews (Costa Neto and Marques 2001). The ethnobiological data were analyzed qualitatively, according to the union model of the different individual competences, considering all the information provided by all the interviewees (Marques 1991). The ATLAS.ti v.23 software was used for the analysis, allowing to organize and systematize the data, after transcribing the interviews to the program. All content was categorized through the search for patterns, themes, regularities or irregularities, in order to carry out theorization and generalization of the data (Coffey and Atkinson 1996).

Based on the interviewees' reports about Caipora and its importance for Serra da Jiboia, a word cloud was generated through the website <https://www.wordclouds.com>, seeking a greater understanding of the interviewees' perception of the subject.

The data obtained from the Multiple Weighting Questionnaire – Likert Scale were statistically analyzed using the Statistical Package for the Social Sciences 25.0 program. As a measure of coherence and internal reliability of the questionnaire, Cronbach's alpha coefficient was used (Alonso and Santacruz 2015; Mattede and Centurión 2015). Factor Analysis of Principal Components (PCA) was performed using the principal components extraction method and the varimax rotation method to correlate and reduce the patterns present in the sets of variables: the statements in question.

Kaiser-Meyer-Olkin (KMO) test (Kaiser 1970) and Bartlett's sphericity test (Bartlett 1950) were performed to measure the suitability of data for factor analysis. The result of the KMO test ranges from 0 to 1, where 1 indicates that the data is more suitable for PCA. A KMO value above 0.6 is considered acceptable for performing a PCA, while values above 0.8 are considered very good for this type of analysis. Bartlett's test compares the analyzed correlation matrix with an identity matrix (null correlation matrix). If the null hypothesis that the variables are independent is rejected, this indicates a significant correlation between the variables and that PCA may be appropriate for analyzing the data in question.

The chi-square test was performed seeking to determine whether there is a significant association between each socioeconomic data collected and the belief in Caipora. Through these analyses, if the p-value obtained is less than 0.05, then the null hypothesis is rejected and it is concluded that there is a significant association between the two variables. Cramer's

Coefficient V test was performed in order to measure the strength of association between these data in conjunction with the chi-square test.

RESULTS AND DISCUSSION

Socioeconomic characterization of the participants

Socioeconomic data correspond to responses provided by 57 research participants (Table 1) who live in the communities of Pedra Branca, Tucaia, Engenho, Cercadinho and Tabuleiro. The group of respondents was composed of men and women with a predominant age group between 50 years and over (64.91%). Regarding the activities carried out, agriculture predominates (61.70%) and occupations such as retired (15.79%), student (3.51%) and domestic (5.26%) were less representative. Regarding religion, Catholicism is cited by the majority (66.67%), but this factor does not interfere with the belief about Caipora (77.19%) as we can see in the statement below:

Below Jesus, she [the Caipora] dominates there! She is the owner of nature (Mr M., 70 y.o.). Caipora, that must be a temptation that comes from afar! I don't know if it was God who left it. Or if it was later generated here on Earth, the Caipora. I go in and out. She makes me dizzy a little bit (Mr V., 96 y.o.).

The Caipora Imaginary in Local Communities: Beliefs and Experiences

Believing in Caipora is related to valuing and conserving the local nature, and can act as a delimiter of the activities carried out in the forest by the interviewed subjects, since the belief in this entity is associated with activities carried out in forest areas. The result of the chi-square test showed a value of $p = 0.04$, indicating that there is a statistically significant relationship between belief in Caipora and activities in the forest. Cramer's V Coefficient value of 0.466 indicates a moderate association between the two variables. This result may be closely correlated with the belief and respect that residents have for the forest and Caipora. In Table 4, it is possible to notice the predominance of extractive activities, such as collecting firewood, and recreational activities, such as going for a walk, associated with a higher percentage of individuals who believe in Caipora: 93.3% and 72.7%, respectively (Table 2).

Collecting medicinal plants and fruits was mentioned only by 3.8% (2 out of 52) of respondents. As for hunting, all 11 individuals who mentioned going to the forest for that purpose said they believed in the existence of Caipora. This is an important aspect since in the region this guardian entity is also known

Tabela 1. Socioeconomic data of the 57 research participants, residents of five communities in Serra da Jiboia, Bahia, Brazil.

Sociodemographic variables	Nº	FR%
Gender		
Female	24	42.11
Male	33	57.89
Age Range in years		
18 to 25	2	3.50
25 to 35	4	7.01
35 to 50	9	15.78
50 to 70	20	35.09
>70	17	29.82
No information	5	8.77
Occupation		
Farmer	36	63.16
Retired	9	15.79
Student	2	3.51
Housekeeper	3	5.26
No information	5	8.77
Other	2	3.51
Religion		
Catholic	38	66.67
Protestant	2	3.51
Umbanda	1	1.75
Without religion	11	19.30
No information	5	8.77
Community		
Cercadinho	15	26.32
Tucaia	12	21.05
Tabuleiro de Elísio Medrado	7	12.28
Engenho	9	15.79
Pedra Branca	14	24.56

as the protective mother of animals, which apparently can limit the action of hunters. It can be inferred that the belief in Caipora favors local ethnoconservation, since this entity is associated with the protection of resources, as observed in the statements below:

I think so! Because until today this one [the woods] of Serra da Jiboia, along with the one next door, Serra da Pelada, accompanied by Morro das Flores. So, she must take care until today. People cut it down and it [the woods] never ends and anyone who wants a leaf

can't find it on the edge of the woods, but in the center, you can find it. So, I say she's still there doing her good deeds. If it did not exist, here it ends, it would catch fire and here in this region there has never been anything like that (Mrs. N., 72 y.o.). She protects everything, she owns nature! (Mr. M., 70 y.o.). I think so. She has power. Each forest has an owner to protect the trees and animals (Mrs. H., 60 y.o.). Everything is ruled by her. She's like the king of beasts (Mr. O., 80 y.o.).

Some young people disclosed their belief in the existence of Caipora and even claimed to have felt its presence in the forest. During the interviews, two individuals aged between 18 and 25 were hesitant to share their experiences related to Caipora, expressing fear of mockery from their social circles. When they entered the forest, they were beaten by Caipora, who used a type of vine to do so. They came back from the forest marked and scared by the beating of the vine. Embarrassed, when asked about the possibility of participating in the interview, they chose not to comment on the matter.

This reluctance to share experiences may indicate the presence of social stigmas associated with beliefs in the Caipora, contributing to the interviewees' apprehension about becoming subject of ridicule. This phenomenon underscores the importance of addressing such topics with sensitivity, respecting individual beliefs, and creating a safe environment for the expression of experiences. It promotes a broader understanding of the cultural perceptions of the interviewed young inhabitants regarding Caipora.

Based on the perceptions and narratives of the interviewed subjects, Dona da Mata presents herself in a range of forms and appearances. The representation of this entity in the popular imagination is intrinsically related to the experiences that people had when entering the forest or the information transmitted orally by the elderly, who are considered the guardians of these stories. According to the collected narratives, Dona da Mata has been described in different ways: an invisible entity similar to the wind that runs through the forest; or as a short, one-legged black woman; a 1.5 m tall teenager; a tall, thin woman who carries a basket on her head; or that her body is split in half, as if it's just a "band". Zoomorphic (a bird) and phytomorphic (Caipora's vine) associations were also recorded. One of the interviewees also reported sexual dimorphism for this entity, with female and male.

Caipora is a woman. She only has one foot, one leg, one arm. She only has one band. She walks kind of bent over like she's dancing. Now it's a visible thing, because when you go to the forest, instead of that, it's a type of vine. Now, she is a one-sided woman. She's spinning, spinning like a balloon, there's

a balloon in the air. But they say the thing is when it's turned into a vine. When she catches people, she is transformed into this vine (Mr. O., 80 y.o.). I've never seen anything, but I like all these things. There must be a male and female. If everything has to have two! That bastard never dies. Yeah, you have to have two! Male and female (Mrs. E., 54 y.o.). She is invisible. Embeds in an animal to trick people! (Mr. J., 51 y.o.). I've heard that she's a boy, like 15 years old. Me too, when I saw it, it looked like a person of about 1.5 meters (Mr. E., 28 y.o.). Caipora is the owner of the woods. Yes, once we got lost and I think it was Caipora. I don't know what animal it is. I don't know if it's a bird or an animal. She took us and hid us for 30 minutes or more. One called the other and no one saw each other. I heard the voice, but I couldn't see her. They say it's a bird (Mrs. C., 70 y.o.).

In reports from hunters, Caipora is described as a zoomorphic entity, capable of transforming itself into various animals native to the region, such as pacas, deer, agoutis, tamarins, and armadillos. This shapeshifting ability is attributed to their supernatural powers and is used to deceive or mislead hunters. Caipora usually use some of these animals as mounts in their activities through the forest, with pacas and caïtutus being the most cited animals in this function, probably due to their size and locomotion capacity. Costa Neto (2000) recorded that the residents of the community of Remanso, in Chapada Diamantina, explained that the Game Master presents himself in an anthropomorphic or zoomorphic way (a large peccary), and his function is related to the protection of nature.

Caipora has a favorite animal, it can be a paca, agouti or armadillo! Every animal she summons herself to stay with, she catches! The hunter can try, but he doesn't catch the game at all, then he knows it's the animal she's riding and doesn't hunt it. And she catches people too! How do you say, on the vine, right? She messes with everyone. Someone runs and does not find the way (Mr. F., 50 y.o.). She can ride any animal. Any herd she touches she rides, peccary or any other herd (Mr. P., 74 y.o.).

Based on the interviewees' perception, a word cloud was created considering all the reports obtained about Caipora and its role as an agent for the conservation of vegetation cover (Figure 2). By highlighting words such as "forest", "nature", "animals", "exist" and "Caipora", the word cloud highlights the relevance of the belief in Caipora as a central element in the cosmivision of these communities, functioning as a guide for their daily activities and contributing to the conservation of the Serra da Jiboia region. Thus, the results reinforce the importance of valuing traditions and cultural practices.

naparte, 1855).

Each one makes their own tobacco and takes it before entering the forest. Go and put it there, before entering the woods. We go in and out, get our firewood. It cuts the tobacco and puts it in any paper, rolls it up neatly and delivers it (Mrs. C., 70 y.o.). *People say, right? That you have to put tobacco on the head of the stump* (Mr. R., 50 y.o.). *It gave smoke to the forest, so you could go in, hunt and get your things. If you didn't do it, you would lose* (Mr. P., 74 y.o.). *Caipora scrambles the mind. She puts a vine. If you cut or hurt the vine, she already got in your way. Then, you walk, you reach the edge of the forest and you can't find the way out. And she puts the vine, a wasp or a moth to get close to you to disturb you. You also feel hot! Everything exists, everything is in the bush* (Mr. F., 50 y.o.).

The offering with rope tobacco left on a stump shows the veneration and fear of Caipora. Caipora's final decision regarding permission for people to conduct their activities highlights the influence of this entity on local customs and its ability to interact with human beings. This relationship between the spiritual and obtaining forest resources is present above all in hunting activities, which are permeated by cosmological aspects that extend from management to meat consumption, and is particularly relevant during the hunt itself (Lopes and Gislot 2022).

Respondents believe that if there is no negotiation with the owner of the forests, if there is disrespect or excessive removal/hunting, punishment is certain. People often have difficulty carrying out tasks or are even interrupted due to, for example, accidents with venomous animals, or they get lost in the woods and cannot find their way home. According to the reports of the residents of Serra da Jiboia, screams, whistles, laughter and sudden winds are heard and felt. That's a warning sign!

The local culture of a given region is permeated by the belief in spiritual entities that directly influence resource gathering practices. These beliefs impose limits on the amount and period of collection, highlighting the relationship between cultural traditions and the management of natural resources (Farias *et al.* 2020; Souza and Alves 2014). Wichi and Criollo people of the Argentinean Dry Chaco believe in the existence of spirits that protect and own wild animals, and that a hunter can see these spirits when overhunting a species, as a signal to the hunter to stop (Camino *et al.* 2018). Menominee tribes of the United States share a similar belief along with other indigenous communities of North America that all nonhumans have spirit and also the entire forest has spirit. This belief system has made the community to respect every creature and the entire forest (Kala 2017). Another example comes from the Jotĩ, who live in

the Amazon rainforest of Venezuela (Zent and Zent 2022). These people need to communicate with the spiritual guardians of animals or plants through songs or dreams, seeking permission and cooperation before attempting to kill or collect. They make counteroffers to balance the exchange. They deposit the skulls of hunted animals in places outside the houses so that the owners can take their spirits back home (spiritual world).

Temperamental wilderness guardians slighted by human trespassers can exact revenge via predator attacks, poisonous snakes, or deadly falls down the side of a cliff. The animal guardian, as the protector of wild creatures, is a potent spirit-being who must be negotiated with to ensure a successful hunt. Thus, hunting can be especially rife with danger (Brown and Emery 2008). Throughout Brazil, these same actions are reported, but they are attributed to Curupira, another supernatural entity from the forests. In addition to inverted tracks, the Curupira also uses whistles and screams to deceive hunters and loggers causing them to lose their way (Costa Neto *et al.*, 2023). This ethnoecological knowledge reveals the relationship of respect and dependence of the communities in relation to entities that protect nature, almost always leading to the abandonment or temporary interruption of activities, as we can see in the following testimonies:

Once there was the story of my friend, a hunter from Tabuleiro do Castro. His dog pointed and picked up an armadillo. About five meters later, he followed and the dog ripped to one side, ripped to the other. When he got close, it was no longer an armadillo. It was a piece of cloth. At the time he dropped the shotgun and never hunted again, he said he would never hunt again (Mr. H., 65 y.o.). *Sometimes we were working with the saw on a moonlit night. Then, when we arrived, the bush shook. I asked my father what it was. He said it was nothing, leave it there, let's go! Then, when we left the forest, he told me that it was the Caipora that wanted to get us. Because when you feel these things in the woods, one cannot speak to the other, otherwise the two are astonished. Hear something, can't run, talk nonsense! Must respect. Every bush has its owner, so you can't curse and mess around. You have to leave things there* (Mr. F., 50 y.o.). *I once went fishing with a friend at night. Arriving at the tank, which is good for giving fish, there was nothing! Then I got goosebumps and so did my friend. When we saw it, in the dark, it had two eyes the height of a person. We light it up and it's gone. It looked like when you shine a light on a dog's eye it's half green, half red. We got scared and went to the forest. Arriving there, it was a windstorm that seemed to want to uproot the trees! And some birds chirping that we had never heard before. We looked*

and there was nothing! We asked the Dona da Mata for permission, then we left there (Mr. E., 28 y.o.).

The possibility of punishment in case of disrespect towards Caipora seems to demonstrate that residents recognize the importance of maintaining a healthy relationship with nature and its protective entity. It becomes necessary, therefore, to understand the relevance of different cultural perceptions in relation to ecosystems and natural landscapes in order to strengthen and develop more effective and systemic strategies aimed at managing ecosystems, considering local cosmovisions and the existence of a supernatural ecology (Costa Neto *et al.*, 2023). Working to enhance cultural traditions, especially themes related to the cosmovision, and valuing the traditional knowledge of local communities is, therefore, an important socio-political instrument to guarantee the conservation of biodiversity and the continuity of extractive activities in a more socio-environmentally safe way. As highlighted by Chunhabunyatip *et al.* (2018), policy makers should engage with local beliefs in order to achieve sustainable resource management and, therefore, such practices should be recognized and included in the government's policies on natural resources management in locations, where indigenous people live for generations.

Factor Analysis

The Kaiser-Meyer-Olkin (KMO) test showed a value equal to 0.58 for sample adequacy, which is satisfactory for performing a Factor Analysis of Principal Components (PCA). Values above 0.5 are generally considered acceptable for PCA. Bartlett's sphericity test resulted in the value of $\chi^2 = 434.884$ and $p \leq 0.05$ (Foster *et al.* 2006). These values indicate that the observed correlation matrix is significantly different from the expected correlation matrix, the variables are highly correlated and the null hypothesis of independence between the variables is rejected, concluding that the PCA is appropriate for these data.

Factor analysis was performed using the Principal Components (PC) method with varimax orthogonal rotation, checking whether the factor loading was greater than 0.30 and with eigenvalues greater than 1. The eigenvalue represents the total variance of each factor in the study (Oliveira *et al.* 2014). The results of the factorial analysis with Varimax rotation indicate four possible main factors correlated with beliefs and ethnoconservation, corresponding to 53.8% of the total data variance (Table 3).

Only one question was excluded (No. 3 – I believe that the forest should be conserved), as it presented a value below 0.30 in its factorial load. The internal consistency test of Cronbach's Alpha was performed, obtaining a value equal to 0.78, which demonstrates

cohesion and reliability in the data obtained from the interviewees, referring to the Likert Scale.

For the analyses, arrangements of numbers (1 to 7 factors) were tested. However, considering the indicators present in the questionnaire together with the values obtained from the rotated data, it was possible to observe that from the fourth factor onwards the graphic design becomes increasingly horizontal, confirming the adequacy of four factors for the analyzes (Figure 3). Each factor was named according to the theme of its items: Factor 1 – Presence of spiritual entities in the forest; Factor 2 – Conservation of natural resources; Factor 3 – Biophilic aspects; Factor 4 – Biophobic aspects. The items that make up each factor, along with their factor loadings, are found in Table 4.

FACTOR 1 – Presence of spiritual entities in the forest

The first factor showed a high factorial and positive load for items related to belief and the presence of spiritual entities in the forest. The factor loadings varied between 0.56 and 0.78, indicating a strong correlation between the items and the central theme. The existence of entities is seen by residents of the Serra da Jiboia region as something important and respectful, as they recognize the signs and punishments of these beings during their tasks in the forest. Item 6 (I make offerings to the spirits that live in the Serra da Jiboia Forest) had the highest factorial load, referring to this first factor.

FACTOR 2 – Conservation of natural resources

This factor is related to the importance of spiritual beings in the conservation of fauna and flora and the belief in punishment for those who do not respect the forest. The factor loadings for variables 18, 19, 20, 10 and 13 were positive, ranging from 0.59 to 0.83. Items 19 (I believe that the person who does not respect nature can be punished by these beings) and 13 (I think that Serra da Jiboia has different spiritual beings that protect animals) stand out for having the highest factorial loads. This may reflect the imagination of communities about the protective role of these entities and their punishments for those who disrespect nature.

FACTOR 3 - Biophilic aspects

In all interviewees, this factor is related to feelings and attitudes of attraction, emotional connection, protection, ideal of belonging and affection that people have in relation to Serra da Jiboia. The factor loadings for variables 8, 1 and 2 were positive, ranging

Tabela 3. Principal factors according to eigenvalues and total variance of rotated data.

Factors	Initial conditions			Varimax rotation		
	Eigenvalues	Total variance%	Accumulated variance %	Eigenvalues	Total variance%	Accumulated variance %
1	4.425	22.126	22.126	3.452	17.261	17.261
2	2.659	13.297	35.423	2.893	14.464	31.725
3	2.035	10.177	45.600	2.247	11.233	42.957
4	1.646	8.228	53.828	2.174	10.870	53.828

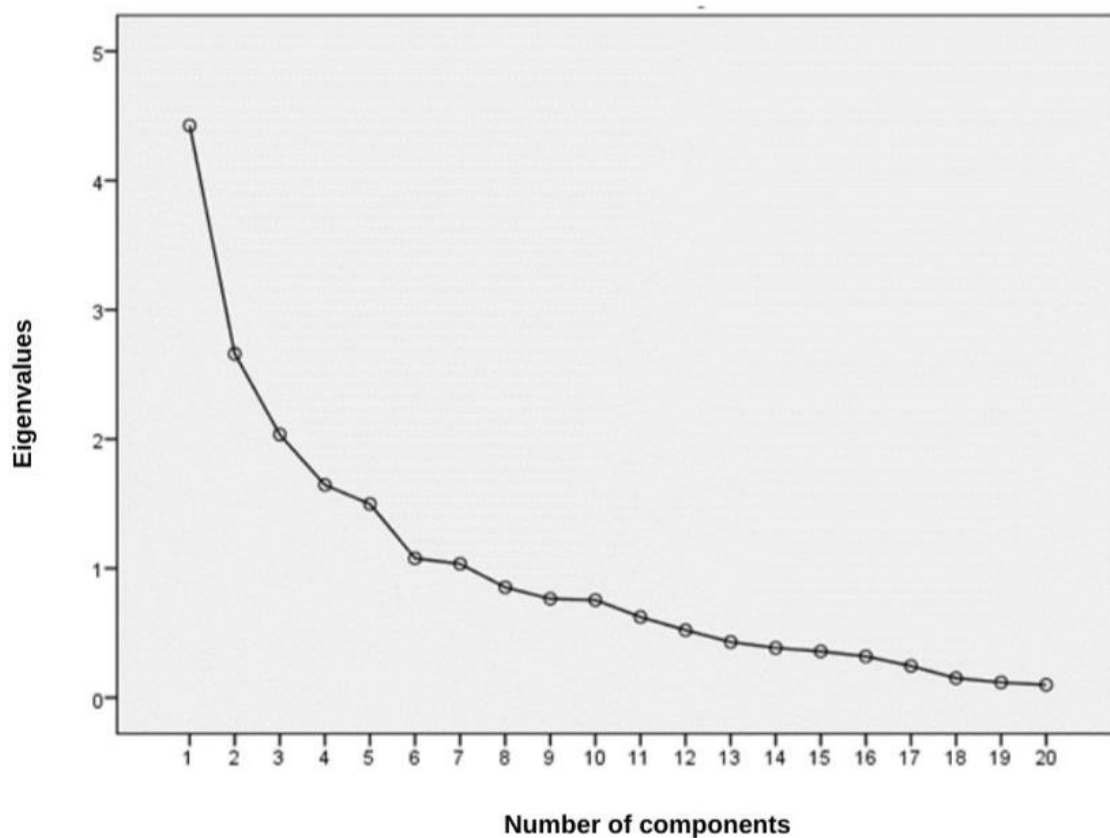


Figura 3. Graphical representation of the eigenvalues associated with the number of factors of extraction.

from 0.60 to 0.74. Item 1 (Serra da Jiboia awakens a pleasant feeling in me) had the highest factor loading of 0.74. This attraction for the forest and for the life close to it encourages residents to seek to conserve both the space that surrounds the communities and the natural elements that compose it. The emotional connection with nature is an important aspect of local knowledge about the region and contributes to the development of practices for preserving and valuing the natural environment. Thus, the affective relationship with Serra da Jiboia can influence the perception and

management of natural resources and lead to more sustainable practices.

FACTOR 4 - Biophobic aspects

This factor refers to the belief that human presence in nature can cause imbalances in nature, the perception of danger when entering the forest and the preservation of places considered sacred by local communities. The factor loading values ranged from 0.50 to 0.69, indicating a correlation between the items and this factor. Item 7 (Serra da Jiboia is dangerous) had

Tabela 4. Items that make up the four selected factors and their factor loadings.

Items	Factor loadings
FACTOR 1 - Presence of spiritual entities in the forest	
6. I make offerings to the spirits that live in the Serra da Jiboia Forest.	0.78
5. I prepare myself with rituals before going into the forest.	0.69
4. I believe that spirits live in the Serra da Jiboia Forest.	0.56
14. I have already seen or perceived the presence of one of those spiritual beings that live in Serra da Jiboia.	0.73
16. I take tobacco or other material with me when I go into or near the forest.	0.71
17. I say a prayer before going or when I am already in Serra da Jiboia.	0.58
FACTOR 2 – Conservation of natural resources	
18. I consider these spiritual beings from Serra da Jiboia to be important.	0.59
19. I believe that the person who does not respect nature can be punished by these beings.	0.83
20. I think these spiritual beings from Serra da Jiboia are beneficial.	0.69
10. I think that different spiritual beings in Serra da Jiboia protect the plants.	0.71
13. I think that different spiritual beings in Serra da Jiboia protect the animals.	0.77
FACTOR 3 - Biophilic aspects	
8. When I go to do some activity in the forest or close to it, I take with me some material that protects me.	0.60
1. Serra da Jiboia awakens a pleasant feeling in me.	0.74
2. I feel attracted to Serra da Jiboia.	0.60
FACTOR 4 - Biophobic aspects	
11. I think that people who enter the forest cause an imbalance in nature.	0.56
12. I think that places that are sacred or special in Serra da Jiboia should not have the presence of people.	0.50
7. Serra da Jiboia is dangerous.	0.69
9. In Serra da Jiboia there are places that are considered sacred or special.	0.63

the highest factorial load, due to the residents' fear of venomous animals, such as snakes, and the risk of accidents when entering the forest, such as falls and other threats. This perception of danger is an important aspect of local knowledge about the natural environment and contributes to the development of practices aimed at protection and precaution on the part of residents who inhabit the region. In addition, the preservation of sacred places is a demonstration of respect and reverence for the forest, demonstrating the close relationship between the cosmivision and the practices of environmental conservation in the region.

CONCLUSION

Residents of at least five communities located on the outskirts of Serra da Jiboia have a strong belief in spiritual beings from the forest, such as the Caipora. For fear of the punishments sanctioned by Caipora, the residents end up granting an important role as an agent in the regulation and management of forest resources, thus acting for the conservation of this important fragment of Atlantic Forest in the state of Bahia.

The results also express the relationships of belonging and positive feelings that residents have linked

to the Atlantic Forest, as well as the recognition that anthropic actions negatively interfere with the natural balance of Serra da Jiboia.

The belief in Caipora can be understood as a central element in the construction of a collective identity and in the promotion of conservation actions for the Serra da Jiboia region. As claimed by Costa Neto and colleagues (2023), it is necessary to combine spirituality and ecology in order to understand and support local beliefs and, in turn, implement ecologically-based strategies for rational conservation of natural resources and maintenance of the rich biocultural heritage associated with them. On the other hand, it is important to highlight the need to promote the perpetuation and respect for beliefs and cultural practices of traditional communities as a way to strengthen their participation in the construction of public policies and to encourage dialogue on the environment and the rational use of natural resources. Only through understanding and acknowledging the different ways of relating to the environment and cultural traditions will it be possible to advance towards more sustainable extractive practices.

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DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

CONTRIBUTION STATEMENT

EMCN and LMPA conceived the research ideas and designed the study.

LMPA carried out the field research.

LMPA and DSF performed data analysis.

LMPA, EMCN and DSF wrote and approved the final manuscript.

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