CHILDREN'S PERCEPTIONS OF NATURE AND PRO-ENVIRONMENTAL BEHAVIORS IN THE TAPAJÓS NATIONAL FOREST, BRAZIL

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Abstract: Children perceive and connect to nature uniquely. A sustained connectedness to nature in childhood fosters pro-environmental behaviors that may endure into adulthood. This study investigates children's self-reported perceptions of nature and pro-environmental behaviors in a riverine community of the Tapajós National Forest, Brazil. The sample included 20 children (8–11 years-aged). Data from focus groups were analyzed through the Discourse of the Collective Subject (DCS) approach. The central ideas and DCS revealed the children-nature contact, along with perceived behaviors related to caring for nature, recognized by kids as their own responsibilities and those of people in their circle.

Keywords: Childhood; Connectedness to Nature; Ecological Behavior; Environmental Psychology; Experiences in Nature.

Resumo: As crianças percebem e se conectam à natureza de forma única. Uma conexão sustentada com a natureza na infância promove comportamentos pró-ambientais que podem perdurar até a idade adulta. Este estudo investiga as percepções sobre a natureza e os comportamentos pró-ambientais relatados por 20 crianças (8–11 anos de idade) em uma comunidade ribeirinha da Floresta Nacional do Tapajós, Brasil. Os dados dos grupos focais foram analisados por meio da abordagem do Discurso do Sujeito Coletivo (DCS). Ideias centrais e DSCs revelaram o contato criança-natureza, bem como os comportamentos percebidos de cuidado com a natureza, reconhecidos pelas crianças como responsabilidades próprias e de pessoas em seu círculo.

Palavras-chave: Infância; Conexão com a natureza; Comportamento Ecológico; Psicologia Ambiental; Experiências na Natureza.

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Introduction

The rapid transformations in Earth's natural dynamics partly mirror the extent of degradation in relationships between humans and other elements of nature. Some of the consequences of these strained relationships include extreme climate events and their multifaceted socioenvironmental impacts on human and non-human lives. Such repercussions prompt us to contemplate new ways to interact with the planet (Higuchi *et al*., 2018; Reigota, 2004).

Children play an active role in environmental protection (Peng *et al*., 2022) and may act as multipliers of pro-environmental behaviors. Engaging with the environment sparks a state of fascination with natural elements and, at the same time, evokes interest in protecting them (Chawla, 2007). However, cultural factors seem to influence the proclivity of individuals to pro-environmental behaviors (Krettenauer *et al*., 2020).

Experiences in nature play a crucial role in fostering connectedness to nature, particularly in young individuals, and increasing awareness of environmental changes, such as small alterations in ecosystem services (Duke; Holt, 2022). Perceiving nature involves an interplay between social actions and physical reality. The establishment of interactions constitutes a cognitive process involving contact with nature through perceptual and sensory means, stimulated by internal (psychological) and external (social and environmental) dimensions. In childhood, individuals begin to gather experiences with nature and, with the help of adults, expand their world and their ability to perceive it. Thus, connectedness to nature nurtures the development of interests, skills, and care in a dynamic manner that varies according to the environment the child is immersed in (Dutra; Higuchi, 2018; Wilson, 2011).

As defined by Benfica, Lauer-Leite and Novais (2025, p. 2), contact with nature comprises “any meaningful human interaction and experience at various levels with flora, fauna, funga, and abiotic elements, as well as physiognomies, landscapes, and geological landform”. These interactions have a multidimensional nature, encompassing cognitive, affective, experiential (Nisbet; Zelenski; Murphy, 2008), and even transcendental aspects — even though the latter is not a prerequisite for individuals to connect with nature (Zylstra *et al*., 2014). Concern for nature is founded and depends on the degree to which an individual believes that they belong to nature, as well as on the level of affection elicited by physical contact with the environment. These factors guide people's actions and promote the development of a cognitive regulation model of concern that drives actions on nature (i.e., behavior).

On the other hand, pro-environmental behaviors can be defined as a set of deliberate and effective actions associated with social and individual dispositions toward caring, protecting, and assuming responsibility for the conservation of natural resources and planetary life (Corral-Verdugo, 2012). Interestingly, Brito (2018) argued that connectedness to nature predicts pro-environmental behavior, which, in turn, mainly arises from real and pleasurable experiences with nature (Rosa; Profice; Collado, 2018) that take place in childhood.

Most of the literature on connectedness to nature and pro-environmental behavior focuses on adults (Liu *et al*., 2022; Olivos-Jara; Aragonés; Navarro-Carrascal, 2013; Rosa; Profice; Collado, 2018). There is a paucity of information on children (Barragan-Jason *et al*., 2023; Barrera-Hernández *et al*., 2020; Duron-Ramos *et al*., 2020; Peng *et al*., 2022), and studies conducted with Brazilian children are even more scarce (Dutra; Higuchi, 2018; Paz; Zacarias; Higuchi, 2022; Zacarias; Higuchi 2021).

Understanding how individuals, especially children, relate to and express themselves in the socioculturally complex environment of the Amazon contributes to the formulation of environmental policies and conservation strategies, as indicated by environmental education studies conducted in this region (Silva; Higuchi; Farias, 2015). Local populations have much to teach us regarding the construction of Amazonian environmental citizenship, drawing from their affective and cognitive experiences with tropical forests and rivers and the ecosystem services associated with them.

Environmental psychology provides essential foundations for environmental education by showing that simply conveying knowledge is not sufficient to promote meaningful change. Gifford (2005) highlights that investigative strategies based on psychological approaches can be effective because they involve practical action and observation, foster personal responsibility, and align with the needs of the target audience. These strategies also emphasize the need to consider human perception when evaluating environmental policies and projects. However, the main challenge remains translating research into practice by integrating theory, behavior, and planning to develop truly sustainable environments. The connection between these fields is not merely technical; it is deeply human and requires an approach that unites science, education, and social engagement.

In view of the foregoing, we investigated children's perceptions of nature and pro-environmental behaviors in the Tapajós National Forest, a protected area in the heart of the Brazilian Amazon. We used the discourse of the collective subject (DCS) method to analyze children's responses and examine how their perception of nature is reflected on a potential sense of environmental concern and responsibility for nature and its services.

Nature experiences and pro-environmental behavior

The construction process of the dynamic relationships in our "common home" takes place at the intersection between culture and nature, shaping personal identities based on respect, affectivity, and a sense of belonging to nature (Leff, 2012). The literature shows that direct experiences with nature in childhood, and the feelings that arise from them, are crucial to promote affection and a sense of belonging, serving as positive psychological triggers (Cheng; Monroe, 2012). That is, connectedness to nature in childhood generates psychological well-being, as well as interest in and emotional affinity toward nature (Finger, 1994; Kals; Schumacher; Montada, 1999). These effects have

repercussions on behaviors that favor environmental conservation, in both children and adults (Chipeniuk, 1995).

People are typically aware that contact with nature is good for them, either because they appreciate the beauty of nature or because it helps them forget about their problems (Kaplan; Kaplan, 1989). For children, contact with nature represents moments in which they coexist with, take care of, or play with natural elements (Macena *et al*., 2023). This experiential contact embodies what literature describes as connectedness to nature, the continuous awareness of the interdependence between one's "self" and the rest of nature (Zylstra *et al*., 2014). This sense of connectedness produces consistent attitudes and behaviors, associated with a stable state of consciousness that comprises cognitive, emotional, and experiential components.

According to Cheng and Monroe (2012), connectedness to nature influences children's intention to participate in nature-based activities. Furthermore, connectedness to nature, in addition to previous experiences with nature and other variables, positively influences interest in performing pro-environmental behaviors. Thus, experience is an important dimension of nature relatedness (Nisbet; Zelenski; Murphy, 2008), comprising contact with the biophysical system and pro-environmental behaviors manifested in this process.

For its part, pro-environmental behavior — here treated as equivalent to ecological or sustainable behavior — can be defined as any human action, intentional or not, that results in reduced negative impacts or positive effects on nature. These actions affect not only the functioning of natural systems and ecosystem services but also the culture and well-being of human populations (Steg; Vlek, 2009).

Reflections on pro-environmental behavior have arisen from environmental movements that ignited international political discussions on new sustainability standards, with values, attitudes, and behaviors focused on environmental protection. It is understood that individual actions play a crucial role in the development of healthy and environmentally sound societies (Tapia-Fonllem *et al*., 2013), often resulting from exposure to stimuli promoted by environmental education efforts aimed at developing environmental citizenship (Higuchi; Azevedo, 2004).

Pro-environmental behavior reflects an enduring organization that combines environmentally conscious ideas and cognitions with affectivity, in support of (or opposition to) a very well-defined social object, characterizing pro-environmental conduct (Galli *et al*., 2018). However, the level of affectivity in relation to the object is correlated with the cultural context in which something/someone is included (Galli *et al*., 2018). For example, the place of residence (rural vs. urban) was shown to be directly and positively linked to children's pro-environmental behaviors, and this relationship was found to be mediated by connectedness to nature (Duron-Ramos *et al*., 2020). Likewise, Barrera-Hernandez *et al*. (2020) observed a significant relationship between

connectedness to nature and sustainable behaviors, which in turn, were found to influence the perceived happiness of children.

Studies investigating pro-environmental behaviors in children, as well as the mechanisms underlying such behaviors, are still scarce in the literature (Barragan-Jason *et al*., 2023; Peng *et al*., 2022). Such knowledge can contribute to the design of natural spaces aimed at children and the development of public policies for promoting environmental education strategies (Peng *et al*., 2022).

According to Rodrigues and Saheb (2018), the relationship between environmental education, nature experiences, and children goes beyond the simple transmission of knowledge. It involves practical and affective interactions with nature that are fundamental for developing sustainable values and attitudes. Direct contact with natural elements — such as plants, animals, and landscapes — stimulates children's curiosity, sense of wonder, and feeling of belonging to the environment, which are essential aspects for fostering ecological awareness.

Limited human and financial resources, extensive territories, and difficulties in access constrain scientific research efforts in interior communities in the Brazilian Amazon, whose ways of life may serve as models for other regions of the planet. In these communities, as well as in other rural areas, frequent and direct contact with nature may act as a driver of pro-environmental behaviors (Duron-Ramos *et al*., 2020), among both adults and children. The biophysical characteristics and seasonality of Amazonian environments shape people's perception of nature (Zacarias; Higuchi, 2021) and possibly influence children's pro-environmental experiences and behaviors. This study aimed to understand children's perceptions of nature and associated behaviors in the Tapajós National Forest, Brazil.

Methods

Participants and setting

This qualitative research (Flick, 2023) included 20 children aged between 8 and 11 years (M = 9.25, SD = 0.96) growing up and coexisting in the São Domingos community (Figure 1) of the Tapajós National Forest, Pará State, northern Brazil. Criteria for participant selection - non-probabilistic convenience sampling - included children of all genders residing in the initial, middle, and final zones of the community, as suggested by community residents.

The Tapajós National Forest is a federal conservation unit of the Brazilian Amazon. Created in 1974, it covers an area of about 527,319 hectares in the municipalities of Aveiro, Belterra, Placas, and Rurópolis (ICMBio, 2021). The extractive community of São Domingos is the first community founded in the Tapajós National Forest. It is in Belterra, being accessible by land and water (Figure 1). The community comprises about 316 individuals from 79 families, whose livelihoods depend on fishing, small-scale rural production, tourism, and extractivism. According to the pedagogical coordination of the local elementary school, the community comprised about 32 children aged between 1 and 12 (incomplete) years at the time of data collection.

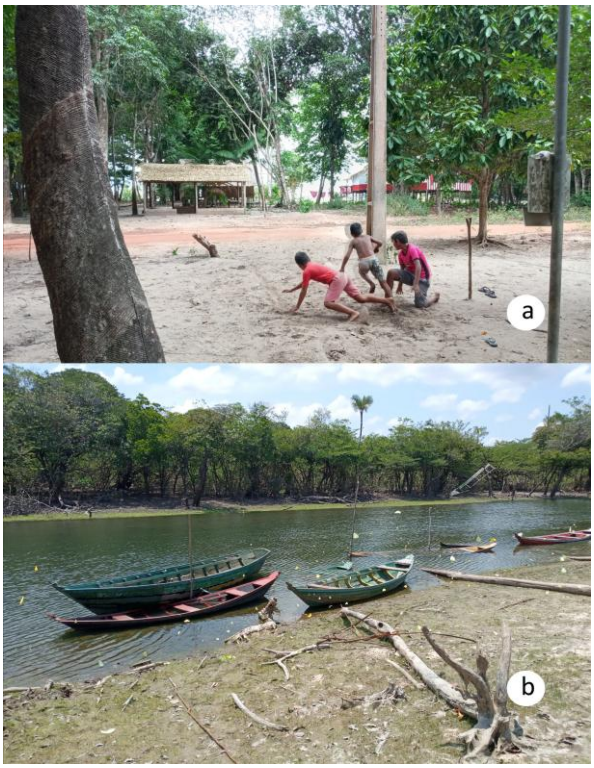

Figure 1: Scenes of life and nature in the São Domingos Community, Tapajós National Forest, Brazilian Amazonia. a. Children playing outdoors. b. Canoes on the Tapajós River.
Source: Authors' archives, from the research.

Ethics, techniques and procedures

The research protocol was approved by the Research Ethics Committee at Pará State University, Tapajós Campus, Brazil (CAAE protocol No. 46992320.9.0000.5168, August 22, 2021). Prior to data collection, parents or legal guardians signed an informed consent form authorizing their children to participate in the survey. Additionally, all children signed an informed assent form before participation. The Chico Mendes Institute for Biodiversity Conservation granted approval for the research (SISBIO license No. 74049-1, January 24, 2020).

Data collection took place in two simultaneous focus groups (Gaskell, 2013), using a semi-structured guide containing specific questions about contact with nature and pro-environmental behaviors. The guide was subjected to a semantic test with eight children living in the São Domingos community, selected for convenience from the social project *Espaço Mãe Natureza*. After the test, minor adjustments were made to the guide to enhance its comprehensibility. Focus groups were conducted at a prearranged time and date. Children were divided into two groups and organized in circles. Each focus group included 10 children and lasted about 20 min. Discussions were moderated by a researcher who has experience with the technique. Questions were presented following the planned script in an informal outdoor setting. Two recorders were used to collect verbal and visual data in each focus group, thereby facilitating subsequent data transcription and analysis.

Qualitative analysis

Verbal data collected during focus groups were transcribed in full. Next, transcribed data were subjected to qualitative analysis by the discourse of the collective subject (DCS) methodological approach, according to the procedures described by Brito, Lauer-Leite and Novais (2022) and Lefèvre and Lefèvre (2005). DCS seeks to assess the self-expression of a social thought or opinion. The DCS approach basically consists of analyzing verbal data and extracting central ideas and key expressions from each testimonial. Each central idea and its respective key expressions form one or more discourses that are written in the first person but represent the thoughts of a collectivity (discourses of the collective subject). The DCS framework comprises the following methodological elements, according to Lefèvre and Lefèvre (2005):

(i) Key expressions: excerpts, fragments, or *verbatim* transcriptions of entire productions that should be underlined in the original individual responses, as they integrate the central ideas of each question asked in the focus group (in the case of this research);

(ii) Central ideas: synthetic, faithful, and precise descriptions of the meaning of each discourse and each identified set of key expressions; and

(iii) Discourses of the collective subject: discourses, written in the first person singular, synthesized by uniting key expressions with the same meaning, that is, resulting from similar or complementary central ideas.

It should be noted that a single central idea may result from the discourse of more than one child. Likewise, a single discourse may contain more than one collective subject, as it may express several central ideas. In accordance with the methodological approach of Brito, Lauer-Leite and Novais (2022), collective subjects referring to similar latent ideas and traits were maintained separately as long as children expressed them in different ways.

Findings and discussion

Amazonian nature and child–nature contact

Riverine children perceived nature through biophysical elements such as forest trees, fruits, flowers, animals, and the wind. Their perception, however, went beyond the cognitive dimension, in that it alluded to the effects that nature exerts on the individual, such as a sense of tranquility. Seven central ideas in the children's discourse synthesize elements that form part of nature, as follows: (i) forest (*N* = 7); (ii) fruits and (iii) animals (*N* = 2 each); (iv) tranquility, (v) proximity, (vi) the wind, and (vii) clean nature (*N* = 1 each). Examples of the Discourses of the Collective Subject can be found in Table 1.

In the affective dimension, animals occupied a more prominent position than other natural elements. The following central ideas express the aspects of nature that riverine children appreciated the most (Table 1): (i) animals (*N* = 11), (ii) fruits (*N* = 4), and (iii) trees (*N* = 1). In the affective dimension, animals

occupied a more prominent position than other natural elements. The following central ideas express the aspects of nature that riverine children appreciated the most: (i) animals (*N* = 11), (ii) fruits (*N* = 4), and (iii) trees (*N* = 1). The speeches reflect biophysical characteristics of the community in which the children live. There are many trees, woods, streams, and rivers. Children's discourses depict their surroundings and trace the culture permeating the community.

Children's perception of nature as a space–time of tranquility. Some central ideas of this experiential aspect include green areas, forests, fruits, and animals. Duran-Lopez, Barrientos-Llosa and Charpentier-Esquivel (2016) associated the presence of green areas with connectedness and contact with nature. Children's discourses reflected elements closely related to their daily lives, including food items and domestic animals, such as "*our sloth at home*," "*rabbits*," "*parrots*," "*parakeets*," "*birds*," "*chickens*." In such a view, elements that have a more direct or symbolic use for humans have greater value (Dulley, 2004), such as food items. Predilection for animals seems to be evidence of plant awareness disparity (Parsley, 2020) or botanical imperceptibility (Ursi; Salatino, 2022). This reflects the common tendency to consider vegetation only as a background of little significance (Schneekloth, 1989).

Morin (2001) reinforces this perspective by arguing that a “terrestrial identity” is built through a sensitive relationship with the planet — something that should be nurtured from early childhood. In addition, Lima (2015) emphasizes that natural experiences, such as handling leaves, feeling the texture of soil, or observing animals, are essential for children’s holistic development, integrating cognitive, emotional, and social dimensions. However, the authors caution that environmental education should not be limited to nature-based activities; it must also include reflections on social justice, diversity, and sustainability. Thus, nature is not merely a backdrop for pedagogical activities but a space for human development, where children learn to care for, respect, and ethically engage with the world around them.

Children recognized the "presence" of nature mainly through folkloric aspects of daily life in their community, such as the *Curupira*, a legendary character in Brazilian folklore that only scares hunters who destroy the forest (Table 1). They acknowledged the presence of nature everywhere, perceiving themselves as part of nature. Children's perceptions about the presence of nature were summarized in 11 central ideas: (i) *Curupira* (*N* = 4); (ii) beautiful forest, (iii) nature is everywhere, (iv) the animals, (v) across the river, and (vi) good (*N* = 2 each); (vii) in Belterra, there is a lot, (viii) big forest, (ix) part of nature, (x) do not cut trees, and (xi) makes you breathe (*N* = 1 each).

Similar to the sense of uniqueness discussed by Cheng and Monroe (2012), Amazonian children perceive themselves as part of nature, a relatedness that can be sustained and expanded by regional culture. The relationships built with the popular imagination reveal a nature that encompasses great socioenvironmental diversity, with resistant beliefs that place care for nature as an aspect of tradition. Thus, environmental education strategies that make use of this

cultural component may be more effective, valuing ideas that occupy a more central position in the belief system of local populations.

Appreciating nature stood out among the activities preferred by children, which include appreciation for landscapes, rivers, and animals (Table 1). In addition to contemplative behaviors, children reported play activities. Discourses revealed seven central ideas: (i) enjoying the scenery (*N* = 5); (ii) caring for plants (*N* = 3), (iii) the animals, (iv) protection, (v) playing (*N* = 2 each); (vi) climbing trees, and (vi) the river (*N* = 1 each). These central ideas were drawn from the speeches of 16 subjects.

Fear of dangerous animals and threats to human survival were somewhat underscored by children in their discourses about what they least like to do in nature (Table 1). Seven central ideas were identified, as follows: (i) dangerous animals (*N* = 3); (ii) nothing, and (iii) stepping in the mud (*N* = 2 each); (iv) killing, (v) puncturing foot, (vi) falling, and (vii) stubbing toe (*N* = 1 each). Actions such as "*planting*," "*watering plants*," "*seeing flowers*," and "*enjoying the natural scenery*" reflect experiences that help characterize children's relationship with nature, whether in the behavioral (Nisbet; Zelenski; Murphy, 2008) or appreciative (Cheng; Monroe, 2012) dimension of connectedness to nature.

Children expressed a predilection for animals among the elements that constitute nature. However, they reported that there is an "*animal that eats [them]*." If animals pose a danger to human beings, even in the field of ideas, they may even be considered to deserve death. People may express disparate feelings toward non-human animals. Whereas some individuals project affinities, others reveal fear and dread of certain species, especially those that are not domesticated. Some of these reactions are instinctive and others are learned through social interaction, such as when spotting snakes and insects, as observed by Cerqueira-da-Silva (2021) in a study with Brazilian children in southern Bahia. When studying the human–animal relationship in the conservation of Amazonian wildlife at risk of extinction, Mateus and Higuchi (2019) concluded that, as people deepen their knowledge about wild animals, they also build the necessary dimensions for coexistence with animals. This represents an important gain in the development of connectedness to nature.

Descriptors of negative affect, such as sadness, pain, hatred, and anger, appeared in participants' speeches about seeing nature being mistreated through tree cutting and animal death (Table 1). The synthesis constructed from the reports revealed six central ideas: (i) sadness (*N* = 4); (ii) deforestation (*N* = 3); (iii) hatred and anger (*N* = 2); (iv) killing, (v) pain, and (vi) evil (*N* = 1 each). With regard to how children perceived the world without nature, nine central ideas were identified, namely (i) no trees (*N* = 7); (ii) no breathing, and (iii) no animals (*N* = 4 each), (iv) no fruits, and (v) no water (*N* = 2 each); (vi) sadness, (vii) death, (viii) no food, and (ix) nothing (*N* = 1 each).

Table 1: Discourses of the Collective Subject (DCSs) of Amazonian children in relation to nature.

ELEMENTS THAT FORM PART OF NATURE ACCORDING TO CHILDREN	ASPECTS OF NATURE THAT CHILDREN APPRECIATED THE MOST
Tree in the forest, the trees, jungle, flower, the plants (S2, S3, S4, S5, S13, S14, S15) Fruits, the fruits (S2, S17) The animals; little birds singing, listen (S3, S18) Nature is [a sense of] tranquility to me (S2) She [the nature] gives the wind (S6)	Animals, I like toucans, woodpeckers, macaws, our sloth at home, rabbits, parrots, parakeets, birds, chickens (S1, S2, S3, S5, S7, S8, S9, S10, S11, S12, S15) I like fruit, pajurá, banana, utiti (S4, S6, S8, S20) The trees (S19)
FOR CHILDREN, WHERE NATURE IS	**KIDS' FAVORITE ACTIVITIES IN NATURE**
The plants . . . there are some things . . . it's like a horse, like a fire on its head, they say it's the mother of the jungle. It's Curupira, the jungle's mother. The mother of the jungle is the Curupira. You have to ask her permission to kill an animal, otherwise she gives you a beating (S6, S8, S12, S13) A forest, beautiful forest. Animals, plants, birds, trees (S2, S3) Trees are nature. Yes, it's everywhere; where we look, there is nature (S1, S5) Across the river (S10, S11) There in Belterra, there is a lot (S6) A big jungle (S8) I am part of nature (S5) Do not cut trees (S7) Because it makes us breathe (S14)	I like to see the flowers, enjoy the natural scenery. See the landscape. Very beautiful landscape (S1, S2, S3, S4, S13) Planting, watering plants (S1, S2, S7) The animals; see the animals (S3, S19) Hunting; I like to kill dangerous animals, animals that eat us (S5, S13) Playing, playing ball (S14, S17) Climbing trees (S1) Looking at the river (S6)
WHAT KIDS LEAST LIKE TO DO IN NATURE	**WHAT CHILDREN FEEL WHEN THEY SEE NATURE BEING MISTREATED**
Bugs, snakes, jaguar, *sucuri* (S2, S5, S12, S17) Nothing, I like everything (S2, S11, S14) Stepping in the mud (S17, S20) Killing the animals (S1) Falling from a tree (S12)	A sadness! Healthy sadness, be sad (S1, S2, S3, S15) Deforestation, clearing trees, clearing the forest (S1, S2, S5) Hatred, anger (S24, S21) Killing animals (S1) Pain (S18) Evil (S21) Trees, leaves, no jungle, no trees, no plants, no fruits (S2, S5, S6, S11, S14, S15, S20) We get very hot, no air, no breathing . . . wind helps to take the polluted air and exchange it for new air (S1, S2, S6, S13) There would be no more animals, birds, fish (S1, S2, S8, S20) We wouldn't have any more fruit, because the trees that give us fruit to eat (S1, S6) Water, there would be no water (S5, S13) I'd be sad (S5) She [the nature] would die (S20) There wouldn't be food (S20) It would be nothing, because it takes most of nature (S4)

Source: Own authorship, based on research data.

The reference to deforestation might be related to the characteristics of the community, which is located in a transition area between a federal conservation unit, supervised by the Federal Government, and a municipal environmental protection area. The region has been deforested for the installment of soybean and maize crops, consequently impacting fauna. Thus, changes in regional ecosystem services are deeply felt by riverine communities.

According to the children, the absence of nature would result in the disappearance of food, water, air, animals, and fruits. This reflects an awareness of the provisioning, regulating, and supporting services provided by Amazonian ecosystems. Biophilic aspects (Kellert; Wilson, 1993) were also perceived in children's discourses. Contemplating a world devoid of nature evoked a sense of sadness in children, underscoring the emotional dimension of their connectedness to nature (Nisbet; Zelenski; Murphy, 2008).

Ecological insecurity is intensified by the perception that traditions and collective values have been replaced by a short-term logic, making it difficult to build long-term projects (Giddens, 2007). In this context, environmental education emerges as a key field for addressing these uncertainties — not only by exposing problems, but by fostering critical reflections on the relationship between society and nature. As Zupelari and Wick (2015) point out, environmental education must go beyond raising awareness; it should encourage concrete actions and promote values such as cooperation and shared responsibility. Its challenge lies in transforming fear and anxiety into mobilization, demonstrating that although the future is uncertain, it can be redefined through educational practices that integrate social justice, sustainability, and care for the planet.

Behaviors related to caring for nature

In their daily life, children were cognizant of human behaviors that have adverse effects on nature, such as littering, polluting, starting fires, and destroying the forest (Table 2). Nine central ideas were drawn from children's perspective about the daily behaviors of individuals and their impacts on nature: (i) don't litter, (ii) fires, (iii) pollution, (iv) good, and (v) bad (N = 2 each); (vi) can't kill trees, (vii) planting, (viii) we don't take care, and (ix) without nature, we die (N = 1 each).

Children took on the role of carers. The discourse about who they thought should play this role (Table 2) generated four central ideas, namely (i) us (N = 5); (ii) God, Jesus, St. Peter (N = 4); (iii) the rain, and (iv) *Samaúma* (N = 2 each). Children were aware of their interdependence with biophysical elements of nature: "*if all nature dies, we don't live, we die*." Cognitively, children appeared to grasp the importance of maintaining nature in equilibrium and exhibited a sense of responsibility toward it (Cheng; Monroe, 2012). According to Saunders (2003), children develop their own vocabulary to express their concern for nature, which can guide behavioral changes in adults with regard to nature. Some of the speeches alluded to spiritual and animistic dimensions. It should be noted that the spiritual dimension of connectedness to nature, understood as separate from

cognitive, affective, and experiential dimensions, still faces epistemological and ontological limitations (Zylstra *et al*., 2014). Tiriba and Profice (2019) reported similar findings when studying the relationship of Brazilian indigenous and North American non-indigenous children with nature. The authors observed that indigenous children reported aspects associated with spirituality or spirits to describe contact with nature, in accordance with their culture. Animism permeated some of the discourses, as evidenced by references to the rain and *Samaúma* — a unique tree occurring in the Amazon — as responsible for taking care of nature.

Overall, children shared the opinion that humans are primarily responsible for caring for nature. Therefore, we assume that children recognize the preponderant role of human behavior in sustaining the balance of nature. According to Tiriba and Profice (2019), children who live in places with traditional populations have a different interpretation of the world than those who live in urban environments. The former group usually view themselves as members or part of nature and perceive nature as a protective being that also requires protection. Similarly, children living in rural areas demonstrate higher rates of connectedness to nature and pro-environmental behaviors than children from urban areas (Duron-Ramos *et al*., 2020). This is probably because children who grow up in urban environments have fewer opportunities for autonomous and direct experiences with nature (van Heel; van den Born; Aarts, 2022). This fact may affect, in the long term, their connectedness to nature and, consequently, the adoption of lasting pro-environmental behaviors. Public and private spaces may support strategies that stimulate physical and psychological connectedness to nature and nature conservation behaviors, such as introducing green spaces in schools, leisure areas, and workplaces (Barragan-Jason *et al*., 2023). It is important to invest in naturalized spaces for children (Santos; Novais, 2024).

Children's discourses produced six central ideas about the actions they take at home to take care of nature (Table 2): (i) planting and caring for plants (*N* = 12); (ii) going to the fields and having a vegetable garden (*N* = 3); (iii) raising animals, and (iv) taking care of nature (*N* = 2 each); (v) seeing the jungle, and (vi) not littering (*N* = 1 each). Furthermore, five central ideas about away-from-home actions to care for nature were identified: (i) watering plants (*N* = 5); (ii) not polluting (*N* = 4); (iii) taking care (*N* = 3); (iv) helping the planet, and (v) planting (*N* = 1 each). Parents and family members also participated in taking care of nature with the following actions, as identified by children: (i) planting (*N* = 7); (ii) caring for the environment, and (iii) the garbage (*N* = 2 each).

Table 2: Discourses of the Collective Subject (DCSs) of Amazonian children on nature-related behaviors.

DAILY INDIVIDUAL BEHAVIORS AND THEIR IMPACT ON NATURE	WHO CHILDREN THINK SHOULD LOOK AFTER NATURE
Don't throw garbage in nature; when we throw garbage in the sea, the fish eat it and die (S1, S2) Fire, burning, fire burns nature (S1, S2) Air pollution, environmental pollution . . . can't pollute the river (S3, S6) I think it's good (S20, S15) Bad (S17, S19) You can't kill the trees (S5) Plant plants (S19) We don't take care [of nature] (S6) If all nature dies, we do not live, we die (S15)	We, us, all of us (S2, S5, S10, S13, S18) St. Peter; Jesus, he throws water from up there, I mean the God (S5, S7, S8, S13) The rain; when it rains, it wets the plants, they grow even more (S8, S13) *Samaúma*; *Samaúma* is a large tree (S1, S7)

ACTIONS TO TAKE CARE OF NATURE
I water the plants. I take care [of plants], water the plants; I plant, plant avocado. Mama likes to plant plants and grow them. Water the plants. We have many flowers at home, I like to plant things . . . plant fruits. We have a plant in front of our house (S1, S5, S6, S8, S9, S11, S12, S15, S17, S18, S19, S20)
Go see the fields. My mother works on the fields. We have a vegetable garden at home (S2, S3, S12)
Mom likes to raise chickens, take care of animals (S8, S10)
Taking care of nature (S17, S14)
Seeing the jungle (S5)
Don't throw garbage on the street (S16)
Water plants, not let them die. Not let cut the trees; water the plants (S2, S17, S20, S14, S19)
Not pollute nature, not make a fire on the beach to dirty the place . . . the beach, nor the woods. Help by not throwing garbage. You can't pollute the sea, the beach, or the rivers (S2, S5, S8, S9)
Taking care (S9, S14, S55)
We need to help the planet (S12)
Plant other [plants] (S14)
Planting, watering. Mom plants cassava to make flour, doesn't let the plants die, takes care of them (S1, S2, S5, S14, S11, S17, S19)
Taking care of the environment (S5, S14)
Not throw garbage (S12, S17)

Source: Own authorship, based on research data.

The most frequent collective discourse was that of planting and caring for plants as a relevant part of caring for nature. Planting also reflects the presence of family farming in the community, promoting daily contact of children with fields and crops. This may represent a utilitarian point of view, given the families' involvement in subsistence agriculture, but it also encompasses a cultural dimension. Agricultural and extractive work, including fishing, is part of the way of life and tradition of many communities living on the banks of Amazonian rivers. Duron-Ramos *et al*. (2020) reported that, residing in the countryside, away from urban centers, increases one's contact with nature. This can motivate pro-environmental behaviors and connectedness to nature, in addition to generating positive experiences via immersion in the local culture.

We found that the experiences of children's family and reference adults can support their bond with nature, by establishing a cultural basis for this relationship (Cheng; Monroe 2012; Paz; Zacarias; Higuchi, 2022; Tiriba; Profice, 2019). Whereas such a connection is a dimension of connectedness to nature, behaviors translate into effective actions to take care of nature. Caring for plants is a form of living in forest spaces and may positively impact children's connectedness to nature and self-perceived pro-environmental behavior.

Conclusions

Amazonian children have a peculiar connectedness to nature, given that the forest is so intrinsically linked to everyday life, producing a *continuum* with their home. Nevertheless, we observed that children's perceptions of nature were linked to some utilitarian biophysical elements and factors related to day-to-day experiences. This finding reveals the need to value vegetation, especially the Amazon rainforest, so that it is perceived as more than just a backdrop to daily life. Formal education can contribute to this objective through curricula that encompass the dimensions of connectedness to nature and how it affects the perceptions and behaviors of individuals about the ecosystem services provided by the Amazon rainforest. Environmental education policies and programs, such as those developed by non-governmental organizations and resident associations, are also welcome, particularly if they value local cultures and the tradition of Amazonian communities in dealing with the environment.

In addition to the experiential dimension, the affective component also integrates the connectedness of children with nature. The feeling of sadness when witnessing forest destruction was alternated with a feeling of tranquility when enjoying nature. The children demonstrated a sense of responsibility for nature and were aware of their actions and those of people in their daily lives with regard to caring for nature. Data reflects the perceptions of children from a typical Amazonian riverine community, which is still poorly represented in literature compared with adult perceptions and discourses. We sought to provide visibility to Amazonian children's discourses by using DCS. These results can provide subsidies for future research aiming to further characterize individuals' connectedness with nature in the Amazon, in addition to supporting policies for education and environmental conservation consistent with the perceptions and beliefs of Amazonian children. The accelerated suppression of vegetation within the Amazon and the deleterious effects of this action on both internal and broader ecosystem services resonate in the riverine children's perception of nature. The development of public policies focusing on biodiversity conservation and sustainable use of natural resources in the Amazon ostensibly aims to (or pretends to) consider the perspectives of local populations. However, children remain silent in this process. Our data indicates that children always have a lot to say about nature, their way of life, and the behaviors we exhibit in the environment. Listening to them should also be a considered step in environmental

policy, especially as we aim to conserve biodiversity for both the present and a future that primarily belongs to children.

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