

Perception and use of fauna resources in communities surrounding a conservation unit in northeast Brazil

Thaise Sousa da Silva^{*} and Eliza Maria Xavier Freire

*Programa de Pós-graduação em Desenvolvimento e Meio Ambiente, Centro de Biociências, Universidade Federal do Rio Grande do Norte, Cx. Postal 1524, 59072-970, Natal, Rio Grande do Norte, Brazil. *Author for correspondence. Email: thaisebio@gmail.com*

ABSTRACT. Biodiversity is threatened by many human activities, and the creation of new Conservation Units (CUs) attempts to reduce this threat. However, this alone has not achieved the expected results. Partnerships are being established with local communities through research that includes the perceptions of these individuals. Environmental Perception has been used to understand and improve the people-environment relationship in these areas. The Caatinga Biome suffers threats and losses from anthropogenic action. Few of its areas are protected by CUs and further conservation efforts are needed. The Seridó Ecological Station (Seridó ESEC) is one of the few CUs in the Caatinga of Rio Grande do Norte State (NE Brazil). An Environmental Perception study was carried out in this area using Ethnozoology concepts to investigate the perceptions of the surrounding communities and use of local fauna. Ninety-two interviews were conducted in 4 communities with 514 statements obtained in 58 vernacular names. The animal most cited was the Rhea (bird) with 58 citations. Its main uses were medicinal or as human food. The rich local knowledge observed may be used in a partnership to correctly manage local resources in the Seridó ESEC.

Key words: environmental perception, ethnozoology, Caatinga, Seridó ESEC.

RESUMO. Percepções e usos de recursos faunísticos por comunidades do entorno de uma unidade de conservação do nordeste do Brasil. A biodiversidade é ameaçada por muitas atividades humanas impactantes, e a criação de novas Unidades de Conservação (UC's), que tentam minimizar essas ameaças, mas por si só, não têm levado aos resultados esperados. O estabelecimento de parcerias com comunidades locais, por meio de pesquisas que incluam a percepção dessas pessoas vem sendo aplicadas. A Percepção Ambiental tem sido utilizada para conhecer e aperfeiçoar a relação homem-ambiente nessas áreas. A Caatinga, Bioma que sofre ameaças e perdas por ações antrópicas, possui poucas áreas protegidas por UC's necessitando desta e de outras ações de conservação. Uma das UC's da Caatinga é a Estação Ecológica do Seridó (ESEC Seridó). Foi elaborado um instrumento de pesquisa baseado na Percepção Ambiental, aliado aos conceitos da Etnozoologia, para conhecer as comunidades que habitam o entorno dessa ESEC, suas percepções e usos sobre a fauna local. Realizaram-se 92 entrevistas em quatro comunidades, obtendo-se, 514 citações, identificadas em 58 nomes vernaculares. O animal mais citado foi a ema (ave) com 58 citações, e os usos em destaque, são: medicinal e alimentação humana. O etnoconhecimento da população mostrou-se rico e pode constituir ponto de partida para o processo de gestão dos recursos naturais da ESEC Seridó.

Palavras-chave: percepção ambiental, etnozologia, Caatinga, ESEC Seridó.

Introduction

Biodiversity conservation is currently an area of much debate. Its varied approaches are also in the spotlight, given that biological communities, which took millions of years to evolve, are being devastated by human activities worldwide (PRIMACK, 2000). Threats to biodiversity are accelerated by the demand of a rapid increase in the human population and the consumption of biological material (CULLEN et al., 2004). This is aggravated by the unequal distribution of these natural resources, especially

in many tropical countries such as Brazil, which have high species diversity.

The poor use of Caatinga resources has caused irreversible damage in this biome. Desertification already affects 15% of the area and the consequences of years of predatory extractivism are visible in the irretrievable loss of flora and fauna diversity (SCHÖBER, 2002). In recent years rural landowners have become increasingly interested in turning part of their properties into protected areas, mainly to preserve the natural environment. However, the number of

Conservation Units (CUs) in the Caatinga is still very low (SILVA et al., 2004).

The Seridó Ecological Station (Seridó ESEC) is one of the CUs in the state of Rio Grande do Norte. It is near an agricultural property and there are many communities within its buffer zone that use its natural resources, often extensively.

The population around the Conservation Units was established before these areas were created. They have their own way of using and handling native and introduced species and their empirical indigenous knowledge is often unknown to the scientific community (TUAN, 1980). This is useful in their daily lives and generally influences the adequate functioning of these Conservation Units.

Tuan (1980) identifies elements that bring people closer to their environment, such as esthetic appreciation, physical contact, health, topophilia, familiarity and patriotism.

Environmental Perception is a research tool used in Educational, Social and Environmental fields to improve the quality of life of people and nature (MARIN et al., 2003). It is also used with other areas of learning to recover and analyze local knowledge and better understand the people-environment relationship.

The concept of Environmental Perception used in this study is the same as that proposed by MAB/Unesco: "A conscious decision and understanding by man of the environment in a wider sense, involving more than individual sensory perception such as vision or hearing" (WHYTE, 1978).

Environmental Perception and Ethnzoology concepts were used in this study to better understand the relationship of man with animals and its perceptions. According to Rocha-Mendes et al. (2005), ethnzoology is the way different populations perceive, classify and understand animal resources.

The interdependence of humans with other natural biotic elements is explained in the biophilia hypothesis described by Wilson (1984) and cited by Santos-Fita and Costa-Neto (2007). It suggests that 99% of man's evolutionary history is intimately connected to other living beings and that humans have an instinctive bond with other species on the planet. The connection varies between attraction, aversion, admiration and indifference and has evolved into a significant information system on environmental species. This is demonstrated by the knowledge, beliefs and cultural practices related to fauna in each area.

Environmental perception and ethnozoology concepts were used in this study to analyze the use of fauna native to the Rio Grande do Norte Caatinga by communities around the Seridó Ecological Station.

Material and methods

Study area

The Seridó Ecological Station (Seridó ESEC) is located in Serra Negra do Norte, Rio Grande do Norte State, in a Caatinga area of 1,166.38 ha between 6°35' S and 37°15' W (Figure 1). It was formed by Decree Law 87222 on May 31st, 1982.

The Seridó ESEC is a relevant area for determining proper management and effective biodiversity preservation. It is the object of studies on biodiversity, geographic distribution and characterization of the main plant standards in the Seridó Caatinga in Rio Grande do Norte State, Brazil. It is also home to many animal species some of these are newly registered and/or endemic to the region. The area is a reference for studies on the fauna and flora of the Caatinga in semi-arid Rio Grande do Norte, since it is the only completely protected CU in the region and relies on interaction with the surrounding population.

Methodology and data collection

A preliminary exploratory study was carried out of the Seridó ESEC and its immediate surroundings. The CU was visited to select communities and people over 18 years old living in the area around the Station for interviews (Figure 1).

A research instrument was then created, based on environmental perception principals proposed by Whyte (1978) and Tuan (1980) and used in studies of Conservation Units (MAROTI et al., 2000; SANTOS et al., 2000; SILVA, 2006). It consisted of a questionnaire with open and closed questions to characterize the interviewees.

Participants were randomly selected and an effort was made to interview at least one person from each household in selected communities to achieve a complete profile of the relationship between the communities and fauna resources.

Data were collected from September 2007 to May 2008 with a mean of one week-long monthly visit to each community. Return visits were made in the following months to houses that were found closed. Subjects were interviewed one at a time, questions were answered individually and the answers were recorded by the same researcher. This method was used to establish intimacy with the interviewees and allow them to talk about their lives, experiences and ideas.

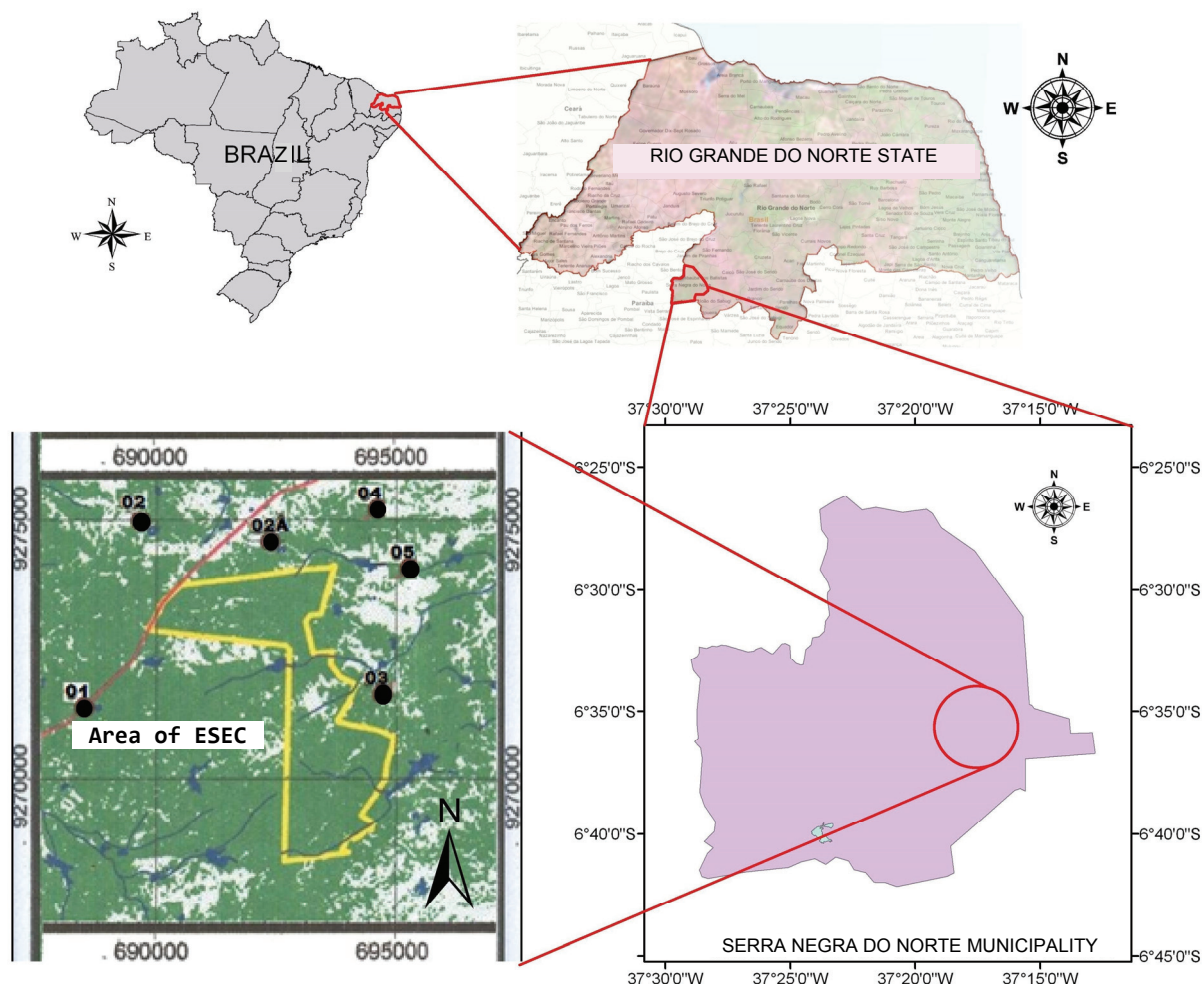


Figure 1. Geographical location of Serra Negra do Norte with the Seridó ESEC highlighted. (Communities investigated: 1) Fazenda Solidão; 2 and 2A) Lagoa da Serra; 3) Fazenda da Coruja; 4) Sítio Carnaubinha; and 5) Sítio Logradouro. Modified from the Seridó ESEC Handling Plan – Ibama.

The vernacular terms cited by 92 interviewees were transcribed in their scientific names using Pough et al. (2003) for vertebrates and Rupert et al. (2005) for invertebrates. The identification was supported by consulting a specialist on local fauna.

The information was then simplistically analyzed (percentages) to retrieve the necessary data. Answers were classified into categories for respective uses, number of citations and scientific classification of each animal. The official endangered species lists from the Ministry of the Environment and the World Health Organization (OMS CID-10) were also consulted to classify the diseases treated when animals were cited as having medicinal properties.

Results and discussion

Only one (0.7%) of the 92 participants interviewed had no knowledge of any animal in the Seridó ESEC.

The others identified one or more native animals with a total of 514 (five hundred and fourteen) citations and 58 (fifty-eight) of these were different animals. Species not native to the Caatinga were excluded from this study.

The vernacular zoological classification is how humans perceive, identify and use the animals considering the traditions and perceptions of each culture (BEGOSS, 1993; RAZERA et al., 2006). The animals most noticed and identified by residents were those they felt a utility or emotional affinity with.

Citations by interviewees in this study were classified into seven zoological groups: Birds (32%), Mammals (29%), Reptiles (19%), Insects (12%), Amphibians (3%), Arachnids (3%) and Fish (2%) (Figure 2). These results show that vertebrates are identified more than invertebrates, confirming the findings of Silva (2006) and Razera et al. (2006). The authors report that larger, more useful animals that have more daily

contact with communities are more easily perceived.

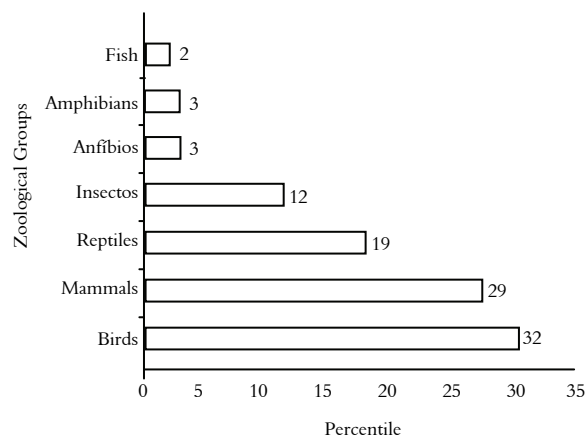


Figure 2. Percentile of zoological groups cited by residents surrounding the Seridó ESEC, Serra Negra do Norte, Rio Grande do Norte State Brazil.

Mammals were identified in seven different vernacular names, 'reptiles' in 11 and birds in 18. Amphibians were cited 8 times and the two animals identified were: frogs (89%) and *Leptodactylus ocellatus* (type of toad) (11%). Both of these belong to the Anura taxon (Table 1). Although they are abundant in the area, spotted tree frogs were not reported. This is probably owing to the fact that they are arboreal and not part of the communities' daily lives. Fish were only mentioned by name once and invertebrates, identified here as insects and arachnids, were cited 19 times and classified into 9 vernacular groups (Table 1). Although invertebrates are smaller than fish they are more present in the daily lives of people in areas of natural vegetation such as the Seridó ESEC. Studies by Costa-Neto, (2000) and Silva (2006) show that land animals, such as birds and mammals and even invertebrates such as insects, are cited more often than fish.

Table 1. List of the vernacular names of animals native of the Caatinga cited in the interviews, organized by taxon, number of citations and uses.

Wider animal group abrangente	Order	Vernacular Nome	Nº. of citations	Use ¹
Insects	Blattariae			
	Hemiptera	Kissing bedbug	01	4
	Coleoptera	Beetle	03	4
	Lepidoptera	Butterfly	01	4
	Hymenoptera	Ant	01	4
	Orthoptera	Cricket	01	4
	Various	Insects	04	4
Arachnids	Araneae	Spider	06	4
	Scorpiones	Scorpion	01	4
Fish		Fish	01	2
Amphibians	Anura	<i>Leptodactylus ocellatus</i> (type of toad)	01	4
		Frog	08	4
Reptiles	Testudines	Mediterranean turtle	04	1, 2, 4
		Red-footed tortoise	04	2, 4
	Squamata	Spix's whiptail	02	4
		Chameleon	06	2, 3, 4
		Rattlesnake	07	1, 4
		Snake	57	1, 2, 4
		Amazon tree boa	09	1, 4
		Pit viper	02	1, 4
		Lizard	01	4
		Black and white tegu	26	1, 2, 4
	Crocodilia	Alligator	08	2, 4
		Tyrant Flycatcher	01	2
Birds	Passeriformes	Caatinga Cachalote	03	2
		Canary	09	2, 3, 4
		Orange-backed oriole	04	2, 4
		Red-Cowled cardinal	03	2, 4
		Black hen	02	2
		Rice grackle	02	2
		Crested caracara	02	4
	Falconiformes	Sparrow Hawk	14	4
		White-winged dove	05	4
	Columbiformes	Field dove	02	3
		Ani	02	4
	Cuculiformes	Wild duck	03	2
	Anseriformes	Owl	03	4
	Strigiformes	Rhea	58	1, 2, 4
	Struthioniformes	Water Hen	02	2, 4
	Gruiformes	Grebe	01	4
	Podicipediformes	Fowl	04	2, 4
Mammals	Carnivoreae	Ocelot	02	2, 4
		Feral cat	11	2, 4
		Jungle cat	08	2, 4
		Margay	02	4

Continue...

...continuation

Wider animal group abrangente	Order	Vernacular Nome	Nº. of citations	Use ¹
Wider animal group abrangente	Didelphimorphia	Fox	41	1, 4
		Jaguar	04	5
		Skunk	02	4
		Racoon	19	2, 4
		Opossum	09	1, 2, 4
	Rodentia	Opossum	05	2, 4
		Central American abouti	04	2, 4
		Cavy	18	2
	Xenarthra	Rock cavy	08	2, 4
		Sex-banded armadillo	52	2, 4
		Anteater	07	2, 4
	Primates	(true) Armadillo	43	2, 4
		Monkey	04	4
		Total = 58	Total = 514	

Key. 1 – Medicinal use. 2 – Human food. 3 – Domestic use. 4 – Nothing and/or nature-related.

The rhea was the animal most mentioned by the population, with 58 citations. It is followed by the snake with 57 citations, the sex-banded armadillo with 52, the (true) armadillo with 43, and the fox with 41. These data are confirmed by the fact that the animals are a significant presence in the daily life of the population. They are also large animals and in the case of rheas and foxes, as well as frequently invading residential property, are used as food, medicine or both (Table 1).

Of the 5 (five) mammal taxa, carnivores were the most cited (34%) followed by Didelphimorphia (24%). The mammal most identified was the sex-banded armadillo (Order Xenarthra). This finding corroborates Silva (2006), who found that carnivores were the most cited animals, given that they have more contact with people, and are often used as food (RAZERA et al., 2006) and in the treatment of disease (ALMEIDA; ALBUQUERQUE, 2002).

The most cited vernacular names for birds were from 13 (thirteen) taxa. The most cited were Passeriformes (45%), followed by Falconiformes and Columbiformes with 11% each (Table 1). The rhea (*Struthioniformes*) was the most identified animal with 58 citations, representing 31% of the birds cited (Table 1). It is the largest bird in and around the Seridó ESEC, appears often on properties and is also used as food and medicine. Another important factor in citing the rhea is that it was previously extinct in the region and was re-introduced when the ESEC was established in the area.

Amphibians from the Anura taxon were cited 8 times and the animal most identified was the frog with 87% (7) of citations. It was followed by *Leptodactylus ocellatus* (type of toad) with 13% (1 citation). Amphibians were not often cited, as interviewees reported feeling aversion for them and did not consider them useful. These animals are also rare during the dry seasons, when most interviews were carried out.

The most frequently identified reptile was the snake with 57 citations (Table 1). A well as being cited

as the most useful animal by participants, they were also feared and respected by the interviewees.

In the invertebrate group, spiders were the most mentioned at 33%. Insects (Blattarie, Hymenoptera, Coleoptera, Lepidoptera, Hemiptera and Ortoptera) were the most cited taxon at 63%, followed by Arachnida (Spiders and Scorpions) with 12 citations. The invertebrates identified by interviewees, such as spiders and scorpions, generally appear in homes. These animals are also most cited in ethnozoology studies using the perception of traditional populations (ROCHA-MENDES et al., 2005; SANTOS-FITA; COSTA-NETO, 2007).

Identified uses for fauna resources

There were four use categories identified by interviewed residents (Figure 3). The first category (Table 1) was the most mentioned with 53% of citations and corresponds to nothing and/or to nature (Figure 3).

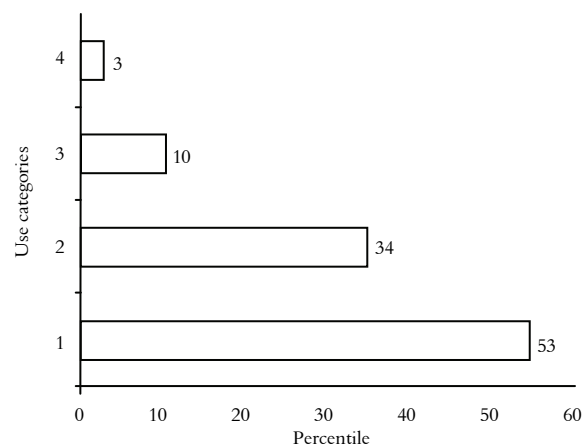


Figure 3. Percentile distribution of animal species according to their use by communities studied around the Seridó ESEC. Key: 1. Nothing and/or nature-related. 2. Human food. 3. Medicinal use. 4. Domestic use.

This occurs because many participants stated that animals not used as food and/or treatment for diseases served no purpose or only nature-related purposes.

The second use category most mentioned by participants was number 2 (Table 1), human food, with 34% of citations (Figure 3). The animals most mentioned such as the sex-banded armadillo, rhea and (true) armadillo are widely used as food by the studied population. This category is also the most identified in other studies where food is included in the uses investigated (SILVA, 2006; RAZERA et al., 2006).

Animals with medicinal properties identified by participants belong to five taxa. Reptiles were the most mentioned and the vernacular name with the highest number of medicinal uses was the snake, with six treatments identified (Table 2). Alves et al. (2007) found similar results that indicate snakes were used to treat muscular pain, rheumatic diseases and others. Although the fox was cited for five treatments in this study, it was not cited for medicinal use in other similar studies (ALMEIDA; ALBUQUERQUE, 2002; COSTA-NETO; RESENDE, 2004; SILVA, 2006).

Table 2. Animals of medicinal use according to residents around the Seridó ESEC, organized by vernacular name, taxon, treatment, disease classification (WHO ICD-10) and the animal part used.

Vernacular name/ taxon	Treatment indicated	Disease classification	Animal part used
Mediterranean turtle/ Testudines	Back pain	V	Meat
Rattlesnake/ Squamata	Anti-inflammatory/ throat/rheumatism	VII, IV, V	Fat
Snake/ Squamata	Anti-inflammatory/ throat/cancer/ analgesic/rheumatism/ wound healing	II, IV, I, III, V, VII	Fat
Amazon tree boa/ Squamata	Throat/Anti-inflammatory analgesic/ rheumatism/animal diseases	IV, II, III, V, VII	Fat
Rhea/ Struthioniformes	Bone pain	V	Fat
Pit viper/ Squamata	Rheumatism	XV	Fat
Fox/ Carnivore	Anti-inflammatory/ hemorrhoids/ throat/rheumatism/cracked feet	II, VI, IV, V, VII	Fat
Black and white tegu/ Squamata	Anti-inflammatory/throat	II, IV	Fat
Lizard/ Didelphimorphia	Rheumatism	V	Meat

Key. I - Neoplasias [tumors]. II - General inflammation. III - Symptoms, signs and abnormal laboratory and clinical exam findings not classified elsewhere. IV - Respiratory diseases. V - Diseases of the osteomuscular system and conjunctive tissue. VI - Genitourinary diseases. VII - Lesions, poisoning and other externally caused disorders. Source: WHO ICD-10.

The diseases cited by residents that were treated with medicinal animals were classified according to WHO (World Health Organization) guidelines. Those most cited were osteomuscular and conjunctive tissue disorders such as back pain and rheumatism, with 28% of citations (Figure 4). Second were lesions, poisoning and other externally caused disorders such as snake bites and general

cuts, with 24% of citations. Respiratory disease (colds, flu and sinusitis) received 20% of citations (Figure 4).

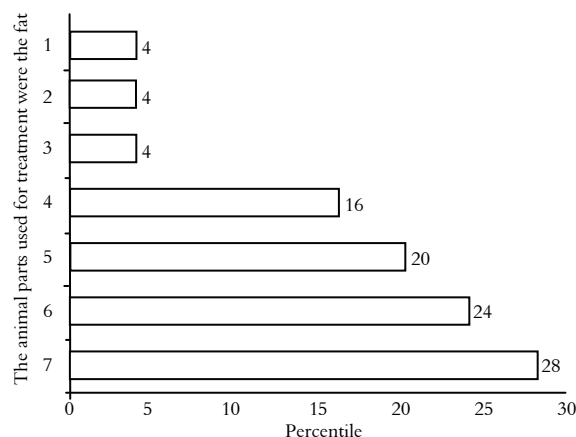


Figure 4. Percentile of diseases identified as treated by using animals cited in interviews with the population around the Seridó ESEC. Key. 1. Neoplasias [tumors] 2. Symptoms, signs and abnormal findings in clinical and laboratory test not identified elsewhere, 3. Genitourinary diseases, 4. General inflammations, 5. Respiratory diseases, 6. Lesions, poisoning and other disorders with external causes, 7. Osteomuscular and conjunctive tissue diseases.

Animals such as the pit viper, which are often cited for medicinal use, are endemic to Caatingas (Eliza Maria Xavier Freire). Other animals cited for food, such as the margay and anteater, are listed as endangered species in Brazil by the Ministry for the Environment. The population is largely unaware of the threat to these species. They may change their attitude if the need to protect the survival of these threatened species was explained. Other studies have found that this is especially true in conservation areas (SANTOS, 2000).

Conclusion

The animals most mentioned by the participants were large animals that were more useful to the community (for food and medicine) and more visible during the day. Food and medicinal uses are significant in poor areas, but these communities also maintain cultural and traditional uses. Local knowledge was rich and many native Caatinga species were identified by the population, demonstrating that studies such as this one recover traditions. This may be a starting point for a partnership between the local and scientific communities and directors to properly manage and preserve the Seridó ESEC.

These communities demonstrate a tradition of rational use of the medicines identified. These may supplement pharmacological studies for the use of

animals in medicine. Alternative animals that are more numerous and not threatened may also be used instead of the endangered animals that are more widely used as medicines, allowing for the sustainable use of animal resources.

Acknowledgements

The authors would like to thank the residents around the Seridó ESEC for their contributions and information used in this study. We also thank Professor Adalberto Antônio Varela Freire for assisting with the identification of the species in the study.

References

- ALMEIDA, C. F. C. B. R.; ALBUQUERQUE, U. P. Uso e conservação de plantas e animais medicinais no estado de pernambuco (nordeste do Brasil): um estudo de caso. **Interciência**, v. 27, n. 6, p. 276-285, 2002.
- ALVES, R. R. N.; PEREIRA-FILHO G.; LIMA, Y. G. C. Snakes used in ethnomedicine in northeast of Brazil. **Environment, Development and Sustainability**, v. 9, n. 9, p. 455-464, 2007.
- BEGOSSI, A. Ecologia humana: um enfoque das relações homem-ambiente. **Interciência**, v. 18, n. 3, p. 121-132, 1993.
- COSTA-NETO, E. M. Conhecimento e usos tradicionais de recursos faunísticos por uma comunidade Afro-brasileira resultados preliminares. **Interciência**, v. 25, n. 9, p. 423-431, 2000.
- COSTA-NETO, E. M.; RESENDE, J. J. A percepção de animais como 'insetos' e sua utilização como recursos medicinais na cidade de Feira de Santana, Estado da Bahia, Brasil. **Acta Scientiarum. Biological Sciences**, v. 26, n. 2, p. 143-149, 2004.
- CULLEN, J. R. L.; RUDRAN, R.; VALLADARES-PÁDUA, C. **Métodos de estudos em biologia da conservação e manejo da vida silvestre**. 1. ed. Curitiba: UFPR, 2004.
- MARIN, A. A.; OLIVEIRA, H. T.; COMAR, V. Environmental education in a context of the complexity of theoretical perception. **Interciência**, v. 28, n. 10, p. 616-619, 2003.
- MAROTI, O. S.; SANTOS, J. E.; PIRES, J. S. R. Percepção ambiental de uma unidade de conservação por docentes do ensino fundamental. In: SANTOS, J. E.; PIRES, J. S. R. (Org.). **Estudos integrados em ecossistemas: estação ecológica de Jataí**. 1. ed. São Carlos: Rima, 2000. p. 163-206.
- OMS-Organização Mundial de Saúde. **CID - 10: classificação estatística internacional de doenças e problemas relacionados à saúde**. 10. ed. São Paulo: USP, 2000.
- POUGH, F. H.; HEISER, J. B.; JANIS, C. M. **A vida dos vertebrados**. 3. ed. São Paulo: Atheneu, 2003.
- PRIMACK, R. B. **A primer of conservation biology**. 2nd ed. Sunderland: Sinauer Associates, 2000.
- RAZERA, J. C. C.; BOCCARDO, L.; PEREIRA, J. P. R. Percepções sobre a fauna em estudantes indígenas de uma tribo tupinambá no Brasil: um caso de etnozoologia. **Revista Electrónica de Enseñanza de las Ciencias**, v. 5, n. 3, p. 466-480, 2006.
- ROCHA-MENDES, F.; MIKICH, S. B.; BIANCONI, G. B.; PEDRO, W. A. Mamíferos do município de Fênix-Paraná: etnozoologia e etnoconservação. **Revista Brasileira de Zoologia**, v. 22, n. 4, p. 991-1002, 2005.
- RUPPERT, E. E.; FOX, R. O.; BARNES, R. D. **Zoologia dos invertebrados**. 7. ed. São Paulo: Roca, 2005.
- SANTOS, J. E. Environmental education praxis toward a natural conservation area. **Revista Brasileira de Biologia**, v. 60, n. 3, p. 361-372, 2000.
- SANTOS, J. E.; JESUS, T. P.; HENKE-OLIVEIRA, C.; BALLESTER, M. V. R. Caracterização perceptiva da Estação Ecológica de Jataí (Luiz Antonio, SP) por diferentes grupos sócio-culturais de interação. In: SANTOS, J. E.; PIRES, J. S. R. (Org.). **Estudos integrados em ecossistemas: estação ecológica de Jataí**. São Carlos: Rima, 2000. p. 163-207.
- SANTOS-FITA, D.; COSTA-NETO, E. M. As interações entre os seres humanos e os animais: a contribuição da etnozoologia. **Biotemas**, v. 20, n. 4, p. 99-110, 2007.
- SCHOBER, J. Notícias do Brasil - Caatinga: preservação e uso racional do único bioma exclusivamente nacional. **Ciência e Cultura**, v. 54, n. 2, p. 6-7, 2002.
- SILVA, G. A. **Unidades de conservação como política de proteção à biodiversidade: uma caracterização perceptiva de grupos sócio-culturais do entorno da APA do Catolê e Fernão Velho, Estado de Alagoas**. 2006. 140f. Dissertação (Mestrado em Desenvolvimento e Meio Ambiente)-Universidade Federal de Alagoas, Maceió, 2006.
- SILVA, J. M. C.; TABARELLI, M.; FONSECA, M. T.; LINS, L. V. **Biodiversidade da Caatinga: áreas e ações prioritárias para a conservação**. Brasília: Ministério do Meio Ambiente, 2004.
- TUAN, Y. **Topofilia: um estudo da percepção, atitudes e valores do meio ambiente**. 1. ed. São Paulo: Difel, 1980.
- WHYTE, A. V. T. **La perception de l'environnement: lignes directrices méthodologiques pour les études sur le terrain**. Paris: UNES-Unesco, 1978.
- WILSON, E. **Biophilia: the human bond with other species**. Cambridge: Harvard University Press, 1984.

Received on October 31, 2008.

Accepted on August 10, 2009.

License information: This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.