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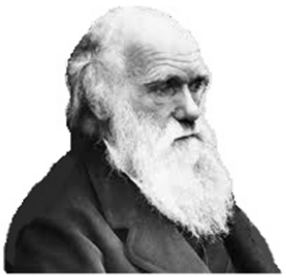

World News of Natural Sciences

An International Scientific Journal

WNOFNS 24 (2019) 239-249 EISSN 2543-5426

The relationship between Bororo Indigenous and the wildlife in the Brazilian Savannah

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ABSTRACT

The objective of this study was accomplishes a knowledge survey of the Bororo indigenous on the mammals of natural occurrence in their territory, Meruri village, who is located in the Mato Grosso State, Brazil, in the Savannah biome, and also the relationship of the indigenous with these wild animals. Open and semi-structured interviews were used as method for collection of the data. Twenty-two indigenous were interviewed, both genres and different ages. The interviewees mentioned 37 species of mammals and they showed a wide ecological knowledge regarding these animals. Such relationships are complex, being evidenced a mythical interaction between the man and the elements of nature. The oral transmission of knowledge occurs across generations.

***Keywords*:** mammals, ethnobiology, ecology, indigenous, Bororo, Brazilian Savannah

1. INTRODUCTION

Traditional ecological knowledge is a system of knowledge that reflects the adaptation of human populations to their environment. Ethnobiology is the scientific study of dynamic relationships among peoples, biota, and environments. As a multidisciplinary field, ethnobiology integrates archaeology, geography, systematics, population biology, ecology, cultural anthropology, ethnography, pharmacology, nutrition, conservation, and sustainable development. The diversity of perspectives in ethnobiology allows us to examine complex, dynamic interactions between human and natural systems [1].

(Received 01 April 2019; Accepted 17 April 2019; Date of Publication 18 April 2019)

The main purpose of this study was to carry out a survey of the knowledge that Bororo indigenous have about the mammals of natural occurrence in territory, located in the Savannah of the Mato Grosso State, in the Brazil.

The Brazilian Savannah is one of the largest and most important biomes in South America, especially because of its high biodiversity. The number of vascular plants is greater than that found in most regions of the world: herbaceous, shrubs, and arboreal plants and vines represent more than 7,000 species [2].

It is estimated that the Bororo indigenous have been living in Center-West Region of Brazil for at least 7,000 years. Available historical sources inform that the initial contact of the Bororo with non-indigenous goes back to the 17th Century. Although today the Bororo possess a discontinuous, deteriorated territory, the vigor of their culture and their political autonomy have been weapons against the predatory effects of their contact with 'the white man', which has been ongoing for at least 300 years [3].

The Bororo economic system is characterized by a combination of the activities of gathering, hunting, fishing and agriculture [4]. The Bororo are still expert hunters and fishermen, in spite of the increasing scarcity of animals caused by the environmental imbalances brought about by agricultural and livestock activities in the regions where they live.

The approach used in this study was qualitative, because the data were obtained through semi-structured interviews, with open dialogues to obtain descriptive data from reports of the target audience [5]. The basis for this work, with the qualitative methodology, covers a socio-affective construction of knowledge, since this knowledge is an integral part of the history and reality of the interviewees.

The objective of the qualitative approach is the level of perceptions and feelings, in constant interaction with the ecological elements, of the meanings, reasons, aspirations, attitudes, beliefs and values expressed in common language and everyday life, seeking to deepen in the complexity of the phenomena.

2. MATERIALS AND METHODS

The studies were carried out in the Meruri village, Bororo Indigenous Territory, from 18 to 30 August 2010. The studied territory is located in the Mato Grosso State, Brazil (**Figure 1**). It is inserted in part of the municipalities of Barra do Garças and General Carneiro. It lies between 15°23'S to 15°44'S latitude and 52°51'W to 53°13'W longitude, covering an area of 823 km^2.

The Meruri village is located on the Garças River basin, in the Savannah biome. The Savannah biome is a complex of phytophysiognomies, a complex of formations, which represents a gradient of ecologically related biomes, reasonable enough to consider this complex as a biological unit [6]. At the edge of the main waterways in Bororo territory, such as Garças River, there is a gallery forest. It is a mixture vegetation of species adapted to temporary flooding, and other species characteristic of semi-deciduous forest [7]. The understory vegetation is variable, being dense in some places and resembling large gaps with sparse and few shrubs [8]. As a method for collecting the data, open and semi-structured interviews were used. Twenty-two indigenous were interviewed, with both genres and different ages, all residents of the Meruri village. According to the sense accomplished in this study, the Meruri village had 425 indigenous in August 2010.

The interviewees were chosen through the own indigenous' indications, based on the knowledge of these people on wild mammals. However, not only those who apparently possess such a knowledge were interviewed, such as hunters and extractivists who spend much of their time in foray into the forest.

Figure 1. Localization of the Bororo Indigenous Territory studied

In addition to the interviews, there were informal testimonies, individual and group dialogues, with the description of the mammal species and their confirmation with the use of a booklet elaborated with colorful drawings of mammalian species of natural occurrence in the region. Through walks along the Savannah and along the border of the Rio das Garças riparian forest, always accompanied by the Indigenous, several species of mammals could be identified and confirmed or visually or by vestiges, such as nests, animal fur, bones, faeces and footprints.

The basis of this approach, with the qualitative methodology, encompasses a socio-affective construction of knowledge, since such knowledge is an integral part of the history and reality of the subjects. The names of the animals in the Bororo language were confirmed through consultations in the Bororo Encyclopedia kindly made available from the collection of Bororo culture in the Meruri village. In this Encyclopedia there is a dense ethnographic description of paramount importance to researchers in all areas. The Bororo Encyclopedia was written by the Salesian missionaries Angelo Venturelli and Cesare Albisetti in 1962.

The term used by the Bororo to designate their original language is *Boe Wadáru*. Linguists classified it as isolated and possibly linked to the *Otuké* branch. Later a new paradigm simplified the classification of Indian languages, grouping them together according to certain similarities, and the Bororo language was placed in the Macro-Jê linguistic branch [9]. According to the National Indian Foundation (FUNAI), which is the Brazilian governmental protection agency for indigenous interests and their culture, nowadays the Bororo language is spoken by almost the entire Bororo population that is estimated around 1,400 people. Thus nowadays in all Bororo villages the majority of the population speaks Portuguese and Bororo. In daily life, the language

used is Bororo, with neologisms assimilated from regional Portuguese, which is used only in inter-ethnic contacts.

3. RESULTS AND DISCUSSION

The indigenous interviewees mentioned 37 species of mammals with natural occurrence in their territory (**Table 1**) and they showed a wide ecological knowledge regarding these animals. The subsistence hunting for Bororo is directed to some of these mammals, as the Tapir (*Tapirus terrestris*), peccaries (*Pecari tajacu* and *Tayassu pecari*), Spotted Paca (*Cuniculus paca*) and the deers: South American Red Brocket (*Mazama americana*), Marsh Deer (*Blastocerus dichotomus*), and Pampas Deer (*Ozotoceros bezoarticus*), by the large size, which implies a higher return of animal protein per unit of hunting effort. Among the primates, there is a preference for the meat of both Black-and-Gold Howler Monkey (*Alouatta caraya*) and Bearded Capuchin (*Sapajus libidinosus*).

Some small and medium mammal's species, as the armadillos (*Euphractus sexcinctus* and *Cabassous unicinctus*), Coati (*Nasua nasua*), and Agouti (*Dasyprocta azarae*), are little hunts despite the abundance and ease of catching these animals. This seems to be related to the great amount of game mammals of large size in the indigenous territory. Species as the Tapir, the Spotted Paca, the peccaries and the deers were reported as existent and available in great amount. The populations of these mammals' species seem not to be affected for the activities of subsistence hunting that it is realized by Bororo in a sustainable way.

The Bororo are expert hunters. The hunting strategies used by the indigenous depend on the species of wildlife being chased, the climate, moon phases, and type of vegetation. The Bororo recognize a wide range of "ecological zones and sub-zones" in the environment that surround them, and the most important among them are *Bokú* (Savannah of Central Brazil), *Boe Éna Jaka* (gallery forest - Savannah transition zones) and *Itúra* (gallery forest). Each ecological zone is associated to specific plants, soils and animals, representing an integrated system of those elements and man. Each zone is also divided into smaller subdivisions, and each division has its importance in the Bororo way of life.

One of the hunting techniques used by the Bororo is known as "waiting". The hunters build a stand near a food source where their target animal species will search for food. This stand is built in the shape of a wooden perch tied with vines between two trees, at a height of two to five meters. The most suitable sites for the construction of the stands are the areas near the streams, where some tree is fruiting and also in the salt lick, which are the sites in the forest where the peccaries, the tapir and the deers seek salt for food.

Still hunting is done by tracking animals down by looking for their tracks, droppings, etc., and following this sign very carefully. When following the animal sign it is important to walk very quietly while constantly scanning for movement and wildlife. It is also important to stop frequently to watch and listen for wildlife around you. Wind direction is another important aspect of still hunting because if the wind is blowing in the direction that you are walking, it is likely that the animal that you are hunting will smell you and scurry before you ever come into contact with the animal.

According to the Bororo hunters, the best phase of the moon for hunting mammals is the crescent moon, "*when the animals feel safer to walk through the forest and savannah, because the dark night makes difficult to see the predator.*"

The Bororo hunters often use domestic dogs to hunt peccaries, tapir, deers, giant anteater and armadillos. These dogs are known by *Arigá* in the Bororo language and they are in great numbers by the villages. They are incredibly thin because of malnutrition. Despite their physical condition, they are extremely useful in hunting because they invest against the animals, which scape in the hollows of fallen trees or even on the trees and became trapped, being easy targets by the indigenous hunters, who use firearms, arrows and bows, spears and cudgels. The cudgel is an indigenous weapon for attack, defense, and hunting, which is long and made of hard wood.

Another hunting technique is with traps and the best example is the trap used to hunt the Nine-banded Armadillo (*Dasypus novemcinctus*). The indigenous name of this trap is *pári.* It is a cylindrical frame made of bamboo and coated main with braided straw from the babassu palm (**Attalea speciosa**). The trap is put in the exit of the armadillo's hole, and the opening of the entrance is wider than that of the exit and so, the armadillo is trapped inside it.

The Bororo do not use fire on their hunts. According to the indigenous, this type of predatory hunting kills indiscriminately all kinds of animals, adults and puppies, some with mobility problems and some other that are often not used in feeding, such as small rodents, reptiles, amphibians and terrestrial microfauna, besides the possibility of fire spreading through other areas, increasing the burning problem.

The Bororo have a lot of knowledge about the ecological importance of the fauna, mainly in the dispersion of seeds of plants that they use in the feeding, as medicines and in the construction of their houses. In this way, as much the hunting as the extractivism of fruits and plants it is realized by Bororo in a rational way, with little enviromental disturbance.

Among the main species of trees registered in the indigenous territory studied and whose fruits are consumed by the Indians are *Annona crassiflora* (araticum), *Byrsonima verbascifolia* (murici), *Caryocar brasilliense* (pequi), *Dypterix alata* (baru), *Eugenia dysenterica* (cagaita), *Eugenia klostzchiana* (savannah pear), *Hancornia speciosa* (mangaba), *Hymenaea courbaril* (courbaril), *Hymenaea stigonocarpa* (savannah jatoba), *Inga alba* (inga), *Pouteria ramiflora* (curriola), *Psidium firmum* (arassa), *Salacia crassifolia* (bacupari), *Talisia esculenta* (pitomba), and the palms *Mauritia flexuosa* (moriche palm), *Acrocomia aculeata* (macaw palm), and *Syagrus oleraceae* (guariroba).

Fruit-eating animals, often related to seed dispersion, are fundamental for the maintenance of the high diversity of tropical plant species [10, 11], and many of these fruits are important in the Bororo diet. Of the plant species of the Brazilian Savannah, the majority of plant species very important as fruit producers, and are eaten by diverse of fauna species. The Annonaceae family is one of the most important in the Brazilian Savannah, and the main genera of it that produce fruit for fauna are *Annona, Rollinia,* and *Xylopia*. The *Annona* genus contains various species that produce edible fruits, like berries, with a large number of seeds, slightly sweet pulp, and a pleasant smell [12].

The Myrtaceae is one of the main families of the Brazilian Savannah, both in number of species and density of trees and shrubs. Among the main seed dispersers of native species of Myrtaceae in the Savannah (especially the genera *Campomanesia, Eugenia, Gomidesia, Myrcia, Myrcianthes, Myrciaria,* and *Psidium*), are several species of monkeys [13, 14], the coati *Nasua nasua*, the Tapir (*Tapirus terrestris*), the deers *Mazama americana* and *Ozotocerus bezoarticus*, several species of rodents such as the Agouti (*Dasyprocta azarae*), and the Spotted Paca (*Cuniculus paca*) [15].

The Tapir (*Tapirus terrestris*), an herbivore specie, is a disperser of intact Annonaceae seeds in high percentages. It is particularly important in the ecological structure of various

species of plants because it can distribute a large quantity and variety of seeds, often acting as a key species. Its absence could cause a breakdown of the key processes in the maintenance of diversity and functioning of the ecosystems [16]. This mammal, whose meat is consumed by Bororo, is very important in maintaining biodiversity in the ecosystems in which they live since they consume and defecate a wide variety of seed species, the majority of which survive intact and are dispersed in dry land areas distant from the parent plant. In many cases this maintaining depends on large frugivores, like tapirs, the deer *Ozotocerus bezoarticus*, peccaries (*Tayassu pecari* and *Pecari tajacu*), and Spotted Paca (*Cuniculus paca*), all species used by Bororo as food [17].

Animals like the Tapir (*Tapirus terrestris*), the largest terrestrial mammal in South America and present in the Bororo territory, plays an important role in the dynamic of the environments in which it lives. Studies find evidence of the importance of the species of palm tree in the diet of frugivores, such as the Tapir [18]. Populations of *T. terrestris* can be affected by forest fragmentation in the long run, seeing that maintenance of large frugivores depends on the high diversity of plants that have fewer scarce periods. The fruits of the palm trees *Astrocaryum aculeatum* (tucuma), *Acrocomia aculeata* (macaw palm), *Mauritia flexuosa* (moriche palm), *Scheelea phalerata* (urucuri palm), and *Syagrus oleracea* (guabiroba) of natural occurrence in the Brazilian Savannah are used in the feeding of the Bororo and they be related feeding and consequent dispersion for the Tapir and others species of mammals as the peccaries [19].

Formerly, most of the Bororo believed that was necessary to bless the meat of certain animals like the capybara, tapir, peccaries, and the male of the Pampas Deer stag by the *bári* (shaman). The last *bári* died in the 1990s and even without the "benzedor" (shaman healer), some people started to eat these meats.

Even today, the daily life of the Bororo includes, in a lesser intensity, the interaction with the spiritual world, with the souls of the dead and other spiritual entities playing important roles in the social life of the indigenous community and in their interaction with nature. According to the studies realized by Lévi-Strauss [20, 21] the báris occupied a central role in the community, and they belonged neither to the physical world nor to the social world, and whose role was to mediate the two kingdoms.

The báris knew the souls and bless the forbidden foods, as certain types of hunting, like the Tapir (*Tapirus terrestris*) considered food of the Bópe, who is the spiritual entity later associated to the devil due to the influence of the Christianity in the Bororo's territories. The báris blessed the tapir so the Bópe did not see that the Bororo were eating one of their hunts. The fact that there is no more bári has influenced the creation of new ways of relating to food. The presence of large carnivores such as the Jaguar (*Panthera onca*), the Cougar (*Puma concolor*) and the Crab-eating Fox (*Cerdocyon thous*) is indicative of good environmental quality in the Bororo territory, as it indicates availability of both species richness and abundance. The Jaguar is the largest feline in the Neotropics. It is an important species within its ecosystem, occupying the position of top predator and is considered an umbrella species within a wide range of habitats [22].

This good environmental quality is also linked to the presence of species such as the Giant Armadillo (*Priodontes maximus*), the Giant Anteater (*Tamandua tetradactyla*), Neotropical Otter (*Lontra longicaudis*) and the Giant Otter (*Pteronura brasiliensis*), which are good indicators of environmental conservation, because they are little tolerant to environmental changes. However, the environmental degradation caused by cattle raising and agricultural

monoculture around Bororo territory is a threat to the survival of this indigenous people. The Bororo greatly appreciate the fur, the teeth and the claws of the Jaguar (*Panthera onca*), with which they make beautiful ornaments, like necklaces. They eat Jaguar meat but according to tradition, "in past ages they did not feed on its meat".

The other animals furs of are also used as carpets and blankets such as Cougar (*Puma concolor*), Ocelot (*Leopardus pardalis*), Marsh Deer (*Blastocerus dichotomus*), Neotropical Otter (*Lontra longicaudis*) and Giant Otter (*Pteronura brasiliensis*). The Neotropical Otter and Giant Otter's are preferred by the Bororo to be used as blanket, "because of the fact that they keep the heat better".

Table 1. Species of mammals presented by Bororo as of natural occurrence in their territory. Nomenclature, taxonomy, Portuguese, Bororo and English names, and diet: Ca (Carnivore), Fr (Frugivore), Fo (Folivore), Gr (Granivore), Hb (Herbivore grazer), In (Insectivore), Myr (Myrmecophage), On (Omnivore), Ps (Piscivore), Se (Seed predator)

ORDER **Family** Taxon names	**Portuguese name**	**Bororo name (ethnospecies)**	**English name**	**Diet**
DIDELPHIMORPHIA				
Didelphidae				
Didelphis albiventris	Gambá	*Aigoréu*	Guaiba Dwarf Mouse Opossum	Fr/On
Gracilinanus agilis	Cuíca	*Aka*	Agile Gracile Opossum	In/On
PILOSA				
Myrmecophagidae				
Myrmecophaga tridactyla	Tamanduá-bandeira	*Búke*	Giant Anteater	Myr
Tamandua tetradactyla	Tamanduá-mirim	*Apógo*	Southern Tamandua	Myr
CINGULATA				
Dasypodidae				
Cabassous unicinctus	Tatu-de-rabo-mole	*Enokúri*	Southern Naked-tailed Armadillo	Myr
Dasypus kappleri	Tatu-de-quinze-quilos	*Reá*	Greater Long-nosed Armadillo	In/On
Dasypus novemcinctus	Tatu-galinha	*Jerégo*	Nine-banded Armadillo	In/On

Euphractus sexcinctus	Tatu-peba	*Bokodoriréu*	Six-banded Armadillo	In/On
Priodontes maximus	Tatu-canastra	*Bokodóri*	Giant Armadillo	In/On
PERISSODACTYLA				
Tapiriidae				
Tapirus terrestris	Anta	*Kí*	South American Tapir	Hb/Fr
ARTIODACTYLA				
Cervidae				
Blastocerus dichotomus	Cervo-do-Pantanal	*Atúbo*	Marsh Deer	Hb
Mazama americana	Veado-mateiro	*Pobógo*	South American Red Brocket	Fr/Hb
Ozotocerus bezoarticus	Veado-campeiro	*Baciéje* (♂) *Orógu* (♀)	Pampas Deer	Hb
Tayassuidae				
Pecari tajacu	Caititu	*Júi*	Collared Peccary	Fr/Hb
Tayassu pecari	Queixada	*Júgo*	White-lipped Peccary	Fr/Hb
PRIMATES				
Atelidae				
Alouatta caraya	Bugio	*Paiceréu*	Black-and-Gold Howler Monkey	Fo/Fr
Cebidae				
Sapajus libidinosus	Macaco-prego	*Júko*	Bearded Capuchin	Fr/On
CARNIVORA				
Canidae				
Cerdocyon thous	Cachorro-do-mato	*Ókwa*	Crab-eating Fox	In/On
Chrysocyon brachiurus	Lobo-guará	*Ríe*	Maned Wolf	Ca/On

Felidae				
Leopardus pardalis	Jaguatirica	*Aipoburéu*	Ocelot	Ca
Panthera onca	Onça-pintada	*Adúgo*	Jaguar	Ca
Puma concolor	Onça-parda	*Aígo*	Cougar	Ca
Puma yagouaroundi	Gato-mourisco	*Aimearéu coréu*	Jaguarundi	Ca
Mustelidae				
Eira barbara	Irara	*Ipoceréu*	Tayra	Fr/On
Lontra longicaudis	Lontra	*Jómo*	Neotropical Otter	Ps
Pteronura brasiliensis	Ariranha	*Ipíe*	Giant Otter	Ps
Procyonidae				
Nasua nasua	Quati	*Kudóbu*	South American Coati	Fr/On
Procyon cancrivorous	Mão-pelada	*Ierarái*	Crab-eating Raccoon	Fr/On
CHIROPTERA				
Phyllostomidae				
Glossophaga soricina	Morcego	*Kedaro*	Pallas's Long-tongued Bat	On
LAGOMORPHA				
Leporidae				
Sylvilagus brasiliensis	Tapeti	*Ámo*	Tapeti	Hb
RODENTIA				
Caviidae				
Cavia aperea	Preá	*Kurúgo*	Brazilian Guinea Pig	Hb
Hydrochaeris hydrochaeris	Capivara	*Okíwa*	Capybara	Hb
Cricetidae				

Oecomys bicolor	Rato-do-mato	*Okiwaréu*	White-bellied Arboreal Rice Rat	Fr/Se
Cuniculidae				
Cuniculus paca	Paca	*Ápu*	Spotted Paca	Fr/Hb
Dasyproctidae				
Dasyprocta azarae	Cutia	*Méa*	Azara's Agouti	Fr/Gr
Erethizontidae				
Coendou prehensilis	Porco-espinho	*Íwe*	Brazilian Porcupine	Fr/Fo/Se
Sciuridae				
Guerlinguetus ignitus	Quatipuru-pequeno	*Kodokódu*	Bolivian Squirrel	Fr/On

4. CONCLUSION

The diversity of mammals presented by Bororo of natural occurrence in the indigenous territory was considered large. Bororo have a lot of knowledge about the ecological importance of the fauna. The indigenous knowledge about the ecological interactions between animals and plants travels through generations from older to younger ones in oral transmission.

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