

DOES ECOTOURISM ACTIVITY AFFECT PRIMATES IN MAMIRAUÁ RESERVE?

A ATIVIDADE DE ECOTURISMO NA RESERVA MAMIRAUÁ AFETA OS PRIMATAS?

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KEY WORDS:

Line transect;
Environmental impact;
Community collector.

ABSTRACT

Mamirauá Institute's Uakari Lodge maintains an ecotourism program, which includes monitoring primates on trails, with a view to evaluating the effects of ecotourism on these animals. The aim of this study was to assess if primate density is affected by ecotourism. Two trails of minimum use (low tourist visitation frequency) and two of intense use (high tourist visitation frequency) were covered using the line transect method. The monitored species were *Alouatta juara*, *Sapajus macrocephalus*, *Saimiri vanzolinii* and *Cacajao calvus calvus*. The data was analyzed using the software *DISTANCE* 6.0. The density variation was analyzed over the years by simple linear regression. The density between the categories was compared using the t-test. This verified a significant difference in the densities of *A. juara* ($t = -5.318$ DF = 6, $p = 0.0017$) and *S. macrocephalus* ($t = -4.601$, DF = 6, $p = 0.0036$) on the trail of intense use, which may be related to increased animal habituation to human presence, as a result of ecotourism.

PALAVRAS - CHAVE:

Transecção linear;
Impacto ambiental;
Coletor comunitário.

RESUMO

A Pousada Uacari do Instituto Mamirauá mantém um programa de ecoturismo que inclui o monitoramento de primatas nas trilhas com a finalidade de avaliar o efeito da atividade nestes animais. O objetivo deste trabalho foi avaliar se a densidade dos primatas é afetada pelo ecoturismo. Foram percorridas duas trilhas de uso mínimo (baixa frequência de visitação de turistas) e duas de uso intenso (alta frequência de visitação de turistas) pelo método de transecção linear. As espécies monitoradas foram *Alouatta juara*, *Sapajus macrocephalus*, *Saimiri vanzolinii* e *Cacajao calvus calvus*. Os dados foram analisados no programa *DISTANCE* 6.0. A variação da densidade ao longo dos anos foi analisada por regressão linear simples. A comparação da densidade entre as categorias de uso foi realizada pelo teste t. Verificou-se diferença significativa nas densidades de *A. juara* ($t = -5,318$; DF=6; $p=0,0017$) e *S. macrocephalus* ($t=-4,601$; DF=6; $p=0,0036$) na trilha de uso intenso, o que pode estar relacionado ao aumento na habituação dos animais à presença humana em decorrência do ecoturismo.

INTRODUCTION

Ecotourism can be described as “trips to natural areas to understand the cultural and natural history of the environment, without altering the ecosystem’s integrity, while creating economic opportunities so that nature conservation brings financial benefit to the local community” (THE INTERNATIONAL ECOTOURISM SOCIETY, 2011). The Mamirauá Institute, through Uakari Lodge, invested in a Community Based Tourism program, in the Mamirauá Sustainable Development Reserve (SDR), aiming to promote the conservation of natural resources and generate income for the local population (PERALTA, 2002).

The Lodge has the logistical capacity to host twenty tourists at a time, with an established capacity to support a maximum of one thousand tourists per year. The Lodge offers a variety of activities, such as canoe rides, visits to traditional communities, meeting with researchers, lectures and videos, interpretative trails and wildlife observation trails. What makes this project unique is that all services are carried out by the residents of local communities. However, like any human activity, ecotourism can cause environmental and social impacts, both positive and negative. The positive impacts include: 1. Increased conservation and preservation of natural areas, archaeological sites and historical monuments; 2. Creation of programs to protect flora and fauna; 3. Appreciation of cultural and artistic heritage; 4. Ethnic pride and improvement of local infrastructure and meeting basic needs. The negative impacts include: 1. Water, air, soil and noise pollution; 2. Degradation of the local flora and fauna; 3. Animal population reduction; 4. Possible change of values and traditional customs of local people when confronted with the lifestyles of the tourists (RUSCHMANN, 1997).

To assess environmental impacts, the Ecotourism Program includes ongoing monitoring of fauna observed on the trails, as well as control of the number of tourists on the interpretative and wildlife observation trails. One of the most common ways to assess the impact on fauna is to conduct a survey of abundances and densities of species occurring in the region of interest. This result can show if a population of a particular species is declining, increasing or remaining balanced over a period of time (CULLEN JR.; VALLADARES-PADUA, 1997).

Due to lack of experience monitoring tourist impact on Amazonian fauna, especially in floodplain areas, it was necessary to find a suitable monitoring method for the activities at Uakari Lodge and for the floodplain environment. The implementation of a census of arboreal vertebrates was proposed in 2005. Using the line transect method, the density and abundance of local fauna on six trails (transects) were estimated. Five species of primates were chosen (*Cacajao calvus calvus*, white uakari; *Saimiri vanzolinii*, black headed squirrel monkey; *Saimiri sciureus cassiquiarensis*, squirrel monkey; *Alouatta juara*, red howler monkey; *Sapajus macrocephalus*, large-headed capuchin) and two bird species from the Cracidae family (*Crax globulosa*, wattled curassow; *Mitu tuberosa*, razor-billed curassow) were targeted for monitoring (PAIM, 2005). The primates were selected for being the most sighted mammals on the trails while the cracids were selected for being hunting targets of local human populations (VALSECCHI, 2005).

Between 2006 and 2007, the method had to be reassessed, as it was considered inadequate for the local reality due to the large number of trails and sampled species. Of the previously selected species, only the primates were kept, while the

number of trails monitored was reduced to four: two intense use (high tourist visitation frequency) and two minimal use (low tourist visitation frequency) (STORNI et al., 2007).

The aim of this study was to investigate whether the density of primate populations has been affected in the different trail use categories, as a result of ecotourism activities promoted by Uakari Lodge.

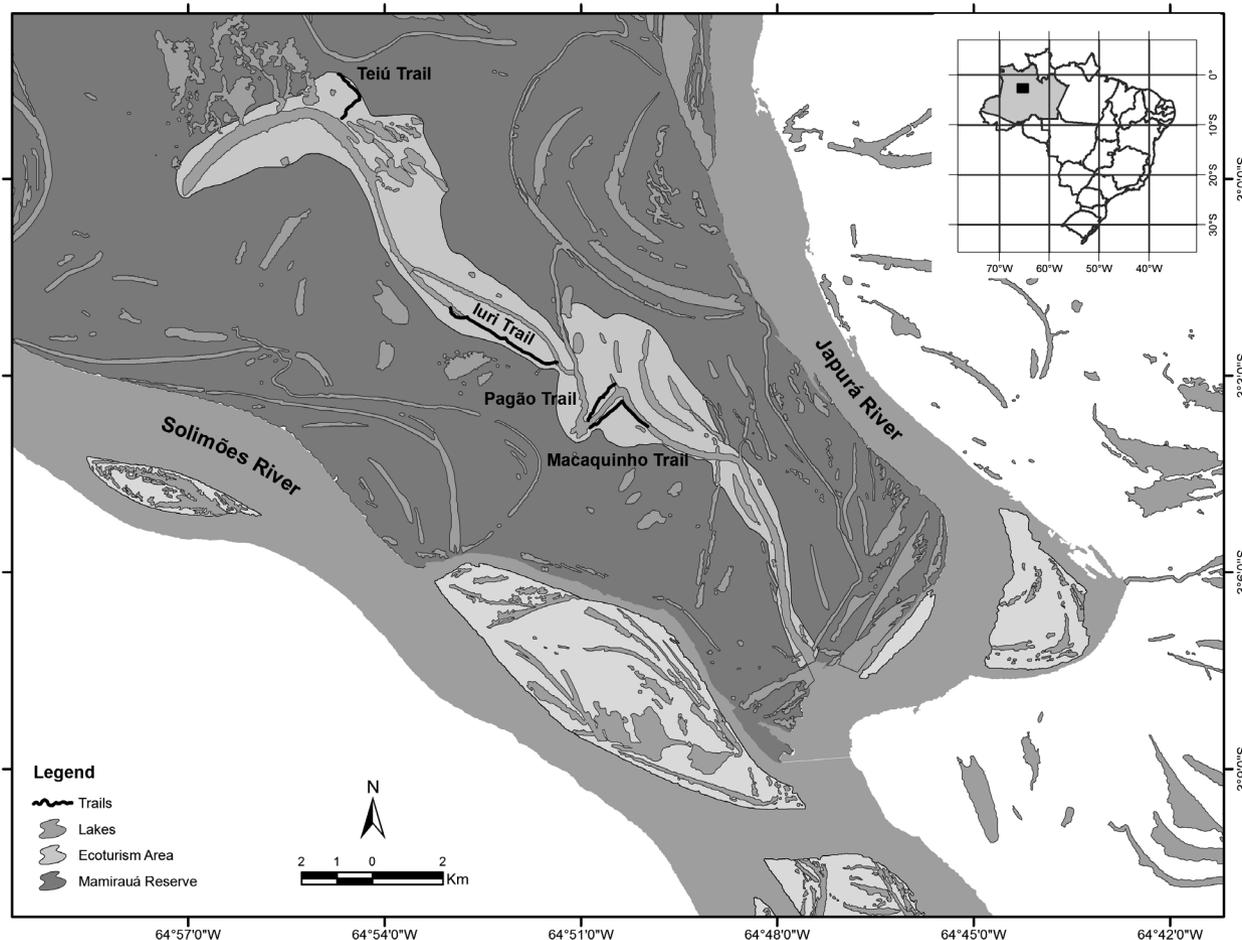
MATERIAL AND METHODS

The ecotourism management zone of the Mamirauá SDR is near the confluence of the Solimões and Japurá rivers, about 30 km from the

Tefé city, in Amazonas state. This area includes Paraná do Mamirauá and its margins, starting from the community of Boca do Mamirauá up to the end of Lake Mamirauá, totaling around 32 km² (03° 00'00" - 03° 07'12" S, 64° 57'01" - 64° 47'59" W) (Figure 1).

This study presents data from 2007 to 2010 collected on two trails of intense use (tourist visitation frequency equal to, or more than twice a week: Macaquinho, 2388 m; Pagão, 1471 m) and minimal use (no visitation at all or it occurs sporadically at intervals of at least three months: Teiú, 1760 m; Iuri, 3150 m) (Figure 1).

Figure 1: Location of trails in the Ecotourism area of Mamirauá Reserve.



The line transect methodology was used (BUCKLAND et al., 1993; THOMAS et al., 1998). In this method, the observers (community collectors or local guides properly trained and qualified by researchers) identify the first animal sighted (before fleeing) and measure the perpendicular distance (shortest distance from the animal to the transection centre) with a tape measure.

All the trails were surveyed for six months of each year: three months during the wet season (April-June), using a canoe, and three months during the dry season (September-November) on foot. The monitoring was conducted between 7:00am and 10:00am and between 3:30pm and 6:00pm (STORNI et al., 2007).

Data was analyzed using the software DISTANCE 6.0 (BUCKLAND et al., 1993). It was tested and selected as the best model (detection function and adjustment agreement), starting from the lowest AIC value (Akaike Information Criterion) and CV (Coefficient of Variation). The density value of each species was calculated in each year for both trail use categories.

A simple linear regression was performed to analyze the variation trends of the species' densities over the years. A comparison of primate densities between both trail use categories was performed using the t-test. Data normality was previously tested using the Lilliefors test. The analyses were done using the software BioEstat 5.0 with a significance level of 5% for all tests.

RESULTS

Throughout the 811.2 kilometers covered, 1448 records were obtained from groups (or social units), including a sufficient number of sightings of *A. juara*, *S. macrocephalus*, *S. vanzolinii* and *C.*

c. calvus for density analysis, in accordance with the recommendations by the software DISTANCE 6.0 (BUCKLAND et al., 1993). However, an insufficient number of sightings was obtained for the other three species (*Saimiri sciureus cassiquiarensis*, *Crax globulosa* and *Mitu tuberosa*).

With the exception of *S. sciureus cassiquiarensis*, all species included in the monitoring were recorded on the four trails. The monitoring activity suggests that *S. sciureus cassiquiarensis* were restricted to the Pagão trail region. Few recordings were made in other areas (Macaquinho, n = 1; Iuri, n = 4) and these were small groups (sub-groups) of up to 10 individuals (5.6 ± 5.0). The curassows were the only ones that were not recorded in each of the years. *Mitu tuberosa* was not recorded on the Pagão trail in 2009, while *C. globulosa* was not recorded on Pagão and Macaquinho in 2007 and 2009, on Pagão in 2008, and in none of the areas in 2010. However, records outside of the period and monitoring sites indicate that the species are present in all areas.

Saimiri vanzolinii was the species which had the highest overall density in each of the years, followed by *A. juara*, *S. macrocephalus* and *C. c. calvus*. Though densities of the four species varied among the years, they do not show a trend throughout the study (Table 1).

Alouatta juara and *S. macrocephalus* presented greater densities on intense use trails, whereas the densities of *S. vanzolinii* and *C. c. calvus* presented no significant differences between years or use categories (Figure 2). There was a significant difference in the densities of *A. juara* and *S. macrocephalus* among the different trail use categories between 2007 and 2010 (Table 2).

Table 1 - Densities, confidence intervals (CI), linear regression and t-test values of the species monitored in the different use categories.

Species	Use category	2007	2008	2009	2010	R ²	P
<i>Alouatta juara</i>	Minimal	19.911	15.863	15.524	20.695	0.026	0.844
	CI	(4.010 – 98.846)	(4.839 – 52.000)	(1.822 – 149.870)	(5.165 – 82.920)		
	Intense	42.162	27.795	34.949	35.656	0.074	0.724
	CI	(18.487 – 96.158)	(2.785 – 277.404)	(12.490 – 97.789)	(7.961 – 159.692)		
<i>Cacajao calvus calvus</i>	Minimal	19.378	7.083	23.484	24.569	0.265	0.486
	CI	(13.590 – 27.630)	(0.917 – 54.695)	(9.645 – 57.184)	(10.014 – 60.279)		
	Intense	14.611	6.995	7.584	24.041	0.22	0.532
	CI	(3.630 – 58.812)	(0.099 – 493.668)	(1.066 – 53.942)	(10.267 – 56.292)		
<i>Sapajus macrocephalus</i>	Minimal	10.722	10.668	8.549	12.523	0.068	0.744
	CI	(2.960 – 38.837)	(6.705 – 16.975)	(2.809 – 26.016)	(7.656 – 20.485)		
	Intense	29.229	19.164	21.072	19.321	0.567	0.246
	CI	(18.090 – 47.227)	(13.465 – 27.275)	(13.301 – 33.384)	(0.434 – 859.295)		
<i>Saimiri vanzolinii</i>	Minimal	63.015	60.654	57.846	80.865	0.397	0.372
	CI	(50.239 – 79.042)	(42.620 – 86.319)	(40.123 – 83.397)	(18.659 – 350.450)		
	Intense	89.058	69.319	58.851	109.418	0.086	0.71
	CI	(21.724 – 365.099)	(39.460 – 121.772)	(21.495 – 161.132)	(62.976 – 190.109)		

Figure 2 - Species density in the different trail use categories throughout the sample period.

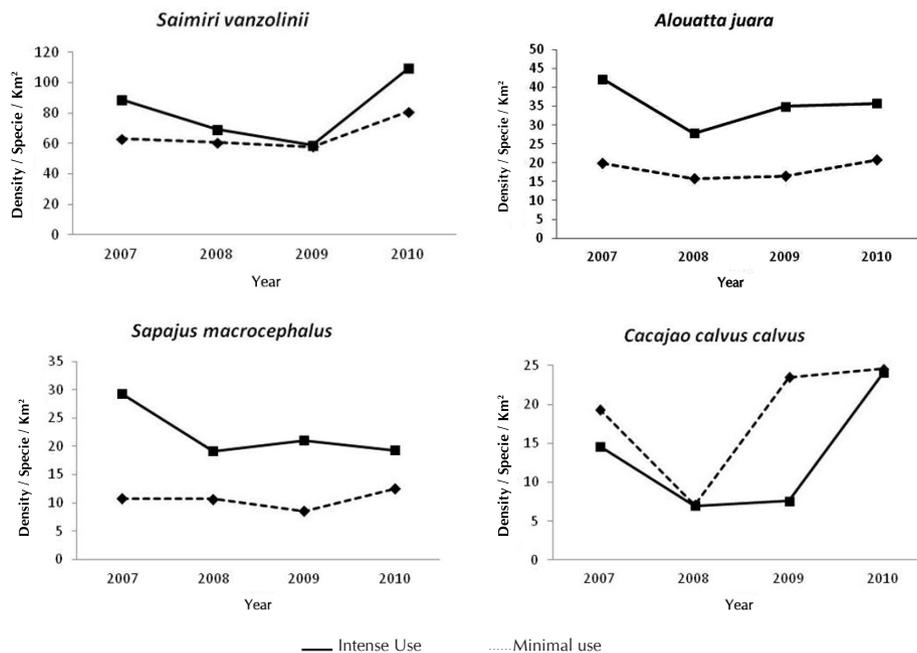


Table 2 - Comparative analysis results between densities recorded on the trails of intense use and minimal use. T-test values shown by species (*significant difference).

Species	t	gl	p
<i>Alouatta juara</i>	-5.318	6	0.0017*
<i>Sapajus macrocephalus</i>	-4.601	6	0.0036*
<i>Cacajao calvus calvus</i>	0.942	6	0.3824
<i>Saimiri vanzolinii</i>	-1.303	6	0.2400

DISCUSSION

The fact that no significant differences were found in the density of *C. c. calvus* and *S. vanzolinii* throughout the study may suggest that the activities undertaken by the Uakari Lodge are not affecting these species. However, *A. juara* and *S. macrocephalus* showed higher densities on intense use trails, indicating the possibility that these primates are habituated to human presence, as a result of visiting tourists. It is probable that this constant visiting process on intense use trails increases the detectability of individuals of these two species, as they do not run away from observers.

Due to interspecific differences (or intergeneric) in the habituation time and reaction of primates to human presence (WILLIAMSON; FEISTNER, 2003), it is possible that *S. vanzolinii* and *C. c. calvus* are also being habituated. From the start of the monitoring activity, *Saimiri vanzolinii* showed no fugitive behaviour, reacting instead with vocalizations and behaviours that suggest curiosity, and spending more time close to monitors and visitors. *C. c. calvus* showed a different response from the start

of monitoring, where individuals exhibited escape behaviour as soon as visitors approached.

Despite the Uakari Lodge encouraging and prioritizing low impact and not allowing tourists to approach the animals, habituation (unintentionally) can cause problems for the population, such as reduced reproductive success and even immunosuppression, resulting in animal illness and death (WOODFORD et al., 2002). In addition, regular contact with humans can cause alterations in primate behaviour, creating changes in population dynamics (migration) and impairing reproduction (WILLIAMSON; FEISTNER, 2003).

Other factors that may influence primate habituation are previous experiences with humans, especially hunting (WILLIAMSON; FEISTNER, 2003). According to Lopes et al. (2012), *A. juara* showed a susceptibility to hunting rate of 9.2 (on a scale of 0 to 10), in a community near Uakari Lodge. *Sapajus macrocephalus* presented a rate of 5.4 for the same region, while *C. c. calvus* and *S. vanzolinii* had rates of 0 and 1.3, respectively. The figures indicate that the latter two species are not hunted for food and are rarely captured or kept as pets.

CONCLUSIONS

Despite the density variations of *A. juara* and *S. macrocephalus* on intense use trails, possibly indicating habituation of the groups on Ecotourism trails, visitation rates can be considered low, especially if compared to the habituation period observed in primate behaviour studies, where human presence is daily (WILLIAMSON; FEISTNER, 2003). We believe that the visitation frequency proposed by the Mamirauá Community Based Tourism Program, as well as the guidance given to tourists, is adequate. Mamirauá visitors do

not get too close to the animals, nor offer them food, as at other tourist sites.

During monitoring, it was also observed that all recorded species still show signs of flight behaviour, maintaining alarm vocalizations, *displays* and other such characteristic behaviours, when perceiving noises or sudden movements, caused by data collectors or tourists. However, changes in the frequency of these behaviours were not quantified in this study.

In spite of the ecotourism area being a specially managed zone where hunting is prohibited, the animals can still find themselves displaced in areas of community use. This movement can occur through daily, seasonal or migratory displacement. However, the maintenance of densities throughout the years, and the hypothesis generated about the existing habituation process, are indications that the monitored species are not under hunting pressure or any other processes that would imply population reduction in the managed ecotourism area in Mamirauá SDR.

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