

REPERCUSSIONS OF THE 2010 EXTREME DROUGHT ON ECOTOURISM MANAGEMENT  
AT THE MAMIRAUÁ SDR.

REPERCUSSÕES DA SECA EXTREMA DE 2010 NO MANEJO DA ATIVIDADE DE  
ECOTURISMO DA RDS MAMIRAUÁ.

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ABSTRACT

The environmental seasonality in the Mamirauá Sustainable Development Reserve (MSDR) gives ecotourism management unique characteristics, both in terms of the availability of ecotourism attractions as well as logistical, operational and economic challenges. The extreme drought in 2010 exemplified an unusual effect on ecotourism activity in the MSDR. In this study, the repercussions of this natural event on ecotourism management were investigated through an analysis of operational costs, visitor satisfaction levels, density of primates on the trails and visitor numbers to the Reserve. The results suggest that, among the indicators evaluated, fuel and some visitor satisfaction items were more sensitive to the rigor of the 2010 drought. Furthermore, there are indications that the event has contributed to the decline in visitor numbers compared to previous droughts.

PALAVRAS-CHAVE:

Ecoturismo;  
Turismo Sustentável;  
Amazônia;  
Pousada Flutuante Uacari;  
Reserva de Desenvolvimento Sustentável Mamirauá.

RESUMO

A sazonalidade do ambiente na Reserva de Desenvolvimento Sustentável Mamirauá (RDSM) imprime características singulares ao manejo do ecoturismo, tanto em termos da disponibilidade de atrativos ecoturísticos quanto com relação aos desafios logísticos, operacionais e econômicos da atividade. A seca extrema de 2010 representou um fato atípico para a atividade de ecoturismo na RDSM. Neste trabalho foram investigadas as repercussões deste evento natural no manejo da atividade por meio da análise dos custos operacionais, dos índices de satisfação do visitante, do índice densidade de primatas nas trilhas e da demanda de visitantes à Reserva. Os resultados sugerem que dentre os indicadores avaliados, o combustível e alguns itens de satisfação de visitantes se mostraram mais sensíveis à rigorosidade da seca de 2010. Ademais, há indícios de que o evento tenha influenciado no declínio do número de visitantes em comparação a secas anteriores.

## INTRODUCTION

Tourism is particularly sensitive to extreme natural events (CIOCCIO; MICHAEL, 2007), in that such incidents can directly impact an activity with different intensities, both with respect to supply (destination) and to demand (visitor). In the specific case of ecotourism, developed mostly by small enterprises and in remote natural areas, vulnerability to events of this nature can be greater and can even hurt the viability of the venture.

When the Mamirauá Sustainable Development Reserve (MSDR) was being developed, and still operating as the Mamirauá Ecological Station in 1990, researchers and academics, along with the local population, proposed the implementation of management activities that would combine the conservation of natural resources with improving the lives of the local population. One of the strategies adopted was the encouragement of community-based ecotourism, which aims to promote the conservation of natural resources while improving the quality of life for the local population (PERALTA, 2008). The municipality of Tefé, which is about 550 km from the capital of the state of Amazonas, is the gateway for ecotourists who visit the Uakari Floating Lodge, a community-based ecotourism enterprise located in the MSDR, near the confluence of the Japurá and Solimões rivers. Currently, eight communities participate in the planning, management and offering of tourism services.

For visitors traveling to Mamirauá Reserve, the main motivating factors for travel are: a) easy observation of Amazon fauna; b) becoming acquainted with the ways of life of local populations; c) learning about the research and conservation efforts carried out in the Reserve and d) visiting a more remote

and preserved area of the Amazon biome, far from the traditional tourist circuits (OZORIO et al., 2012).

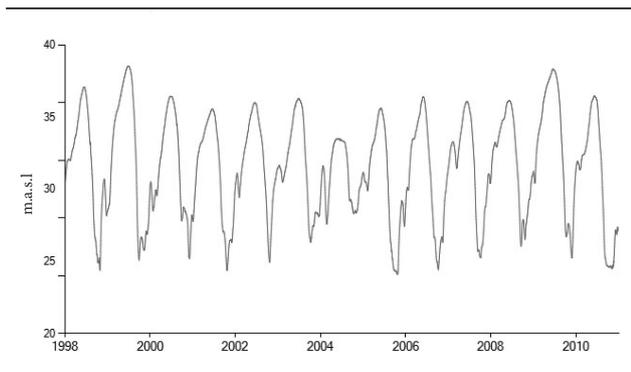
The activities developed in the ecotourism packages include: motorized canoe tours, paddle canoe tours in flooded forest areas, trail tours, traditional fishing (optional), overnight stays in a little bush house, night tours, visits to local communities, meetings with researchers and lectures about the Mamirauá Institute.

Variation in water levels is an inherent characteristic of the Middle Solimões region. The abundance and seasonality of rainfall in the Andean region causes an annual, regular and monomodal fluctuation in the water level of the Amazon River, with amplitudes that exceed 13 metres (RAMALHO et al., 2009). This variation gives the region unique scenic characteristics and unusual wildlife-watching opportunities. At the same time, ecotourism tours are influenced by this environmental seasonality and the nature of the activities varies depending on the water level. In the drought period, ecotourists visit the trails to observe the flora and fauna, while during the flood period, the flooded forest is visited by paddle canoe (OZORIO et al., 2012).

This variation in water level can increase the challenges of ecotourism management in the MSDR, both from an economic and operational point of view, affecting the enterprise and the nearby urban centres, both of which impact the success of ecotourism activities. In 2010, the second lowest level of flooding (24.49 M.a.s.<sup>1</sup>) was recorded in the MSDR since the start of fluviometric monitoring (MISD, 2011) (Figure 1)

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<sup>1</sup> Mestres above sea level



(Source: Mamirauá Institute for Sustainable Development, 2012)

Figure 1 - Water levels in the MSDR between 1998 and 2010

A sharp decline in the water level, as seen in 2010, can hamper or lessen the quality of the activities developed for ecotourists, which in turn can negatively impact their evaluation of their experience during the visit. An example of this is related to activities aimed at observing wildlife, which is the principle element of ecotourism in the Sustainable Development Reserve.

Mamirauá is the ideal place for observing fauna, including “charismatic” species like the white uakari monkey, the black caiman, the *pirarucu* fish and the pink river dolphin, located in remote, breathtaking landscapes in the Amazon (PERALTA, 2002). If the extreme variation in water levels adversely affects wildlife sightings, the visitor may perceive the ecotourism experience as one of lesser quality. Thus, this study aims to evaluate the negative impact of the 2010 drought on ecotourism management in the MSDR, in order to measure the susceptibility of the activity to extreme natural events, and thereby generate support to outline strategies to minimize the impact in case such events happen more frequently.

## MATERIAL AND METHODS

The first step in the methodology adopted for this study was the selection of indicators that would allow for the assessment of the possible impacts of the 2010 drought on ecotourism management in the MSDR. To achieve this, the following indicators were chosen: operational costs of the activity, visitor satisfaction ratings, density of a primate species [black-headed squirrel monkey (*Saimiri vanzolinii*)], visitor influx and tour package cancellations. All indicators refer to the drought period, which occurs between September and December, in the Middle Solimões region. Table 1 gathers the chosen indicators with their respective units of measurement, their period of analysis, as well as the time frame chosen for each one.

In the indicators related to operational costs, the amount spent on each item was divided by the number of visitors for the period<sup>2</sup>. The percentage difference between years was measured, as well as the year over year percentage change. A similar methodology was applied to the visitor satisfaction rating and to visitor influx. Regarding primate density on the trails, the black-headed squirrel monkey (*S. vanzolinii*) was used as an indicator because it is a species with restricted distribution (AYRES, 1985; PAIM, 2008), vulnerable to extinction (PAIM, 2008; SILVA JR.; QUEIROZ, 2008; PAIM; QUEIROZ, 2009; IUCN, 2010), and considered one of the important ecotourism attractions in the MSDR due to its endemism. The species densities were calculated using the Distance 6.0 program. Subsequently, the percentage change of the densities over the years was measured.

<sup>2</sup> For comparison purposes, since it is about variable costs - which vary according to the number of visitors.

Table 1: Summary of the indicators analyzed.

Indicators		Possible impact on ecotourism management	Calculation	Period analyzed (month)	Time frame
Operational costs	Fuel	An extreme drought can increase operational costs and jeopardize the enterprise	R\$/No. of visitors	Sept to Dec	2006 to 2010
	Food		R\$/No. of visitors	Sept to Dec	2006 to 2010
	Services provided		R\$/No. of visitors	Sept to Dec	2006 to 2010
Visitor satisfaction	Transfers	An extreme drought can have a negative influence on the evaluation of an experience by an ecotourist	Rating from 0 to 5 <sup>1</sup>	Jul to Dec	2006 to 2010
	Wildlife viewing		Rating from 0 to 5	Jul to Dec	2006 to 2010
	Tours		Rating from 0 to 5	Jul to Dec	2006 to 2010
	Overall evaluation of the visit		Rating from 0 to 5	Jul to Dec	2006 to 2010
Primate density	<i>Saimiri vanzolinii</i>	An extreme drought can lessen primate <sup>2</sup> sightings	Animals/km <sup>2</sup>	Sept to Dec	2007 to 2010
Tourist numbers	Visitor influx	An extreme drought can lessen visitor influx to the enterprise	No. of people	Sept to Dec	2006 to 2010
	Tourist package cancellations		No. of cancellations	Sept to Dec	2009 and 2010 <sup>3</sup>

<sup>1</sup> Where 0=very bad; 1=bad; 2=normal, 3=good, 4=very good and 5=excellent.

<sup>2</sup> An important ecotourism attraction in the MSDR

<sup>3</sup> There is no data available for prior years.

## RESULTS AND DISCUSSION

The analysis of operational costs indicates that all three cost components increased in the 2010 drought season (Table 2). However, when analyzing the year over year percentage change, a clear difference was identified for the fuel item (Table 3).

The purchase of fuel for Uakari Lodge is made through a bidding process and the contracted price in 2010 did not change due to the drought. However, there was a substantial increment in

fuel consumption because the venture's supply logistics became more complex during this period of extreme drought. Distances were greater at the peak of the drought and many spots became inaccessible, resulting in a substantial part of the supplies (such as food, fuel, etc.) being transported using the Lodge's own vessels, since the boats that normally support this effort were not able to reach their final destination.

However, it cannot be ruled out that the increase in fuel consumption could also have been related to inefficient operations.

Table 2 - Annual percentage difference of the indicators used to evaluate the impacts of the drought.

Indicators		2006	2007	2008	2009	2010
Operational costs	Fuel	169	149(-12%)	133 (-10%)	126(-5%)	195 (55%)
	Food	155	124 (-20%)	174 (41%)	218 (25%)	266 (22%)
	Services provided	108	150 (39%)	132 (-12%)	143 (8%)	170 (19%)
	Total	432	423 (-2%)	439 (4%)	487 (11%)	631 (30%)
NCPI <sup>1</sup>		3.14 %	4.46 %	5.90 %	4.31 %	5.91 %
Visitor satisfaction	Transfer	4.27	4.29(1%)	4.58 (7%)	4.38 (-4%)	3.96 (-9%)
	Wildlife viewing	4.36	4.46 (2%)	4.38 (-2%)	4.39 (0%)	4.20 (-4%)
	Activities	4.31	4.52 (5%)	4.38 (-3%)	4.39 (0%)	4.28 (-2%)
	Trail tours	4.20	4.32 (3%)	4.17 (-3%)	4.17 (0%)	4.10 (-2%)
	Canoe tours	4.51	4.52 (0%)	4.52 (0%)	4.63 (2%)	4.28 (-8%)
	Overall evaluation	4.50	4.69 (4%)	4.54 (-3%)	4.54 (0%)	4.36 (-4%)
Primate density	<i>Saimiri vanzolinii</i>	-	21.199	21.996 (4%)	16.40 (-25%)	28.678 (75%)
Tourist numbers	Visitor influx	184 <sup>2</sup>	261 (42%)	233 (-11%)	227 (-3%)	178 (-22%)
	Cancellations	N.A.	N.A.	N.A.	8	48
Value USD/R\$ Average (2nd semester) <sup>3</sup>		2.06	1.71	1.90	1.74	1.66

<sup>1</sup> NCPI - National Consumer Price Index (IBGE - Brazilian Institute of Geography and Statistics).

<sup>2</sup> 2006 was an atypical year, due to the closure of the Tefé airport. This episode led to a considerable decline in visitors for that year.

<sup>3</sup> www.oanda.com

Table 3 - Percentage change between periods.

Indicators		Percentage change (in %)		
		From 2006/2007 to 2007/2008	From 2007/2008 to 2008/2009	From 2008/2009 to 2009/2010
Operational costs	Fuel	2	5	60
	Food	61	-16	-3
	Services provided	-51	20	11
	Total	6	7	19
Visitor satisfaction	Transfers	6	-11	-5
	Wildlife viewing	4	2	-4
	Activities	-8	3	-2
	Trail tours	-6	3	-2
	Canoe tours	0	2	-10
	Overall evaluation	-7	3	-4
Tourist numbers	Influx	-53	8	-19

The value fluctuations registered for food expenditure and services provided can be the result of other factors, such as inflation, management problems and changes in the venture's operational model.

The supply logistics for perishable and non-perishable items in Uakari Lodge can also be affected by the drought. Among the perishable items, only fish and some fruit are produced in Tefé. Foods like chicken and some greens and vegetables are transported by boat from Manaus to Tefé. During the drought period, however, the supply of fish increases, consequently decreasing the price. Therefore, even considering that items coming from Manaus increase in price, one of the major contributors to food expense – fish - balance out this variation.

Non-perishable items are less susceptible to price variation because most of them are stored by local suppliers. However, it is important to point out that, if drought events become more frequent, and especially, long lasting, these items can be obtained the same way as those that cannot be stored in large quantities.

Regarding values for services provided, normally changes are not observed during these climatic events. However, it may be necessary to contract additional service providers, depending on the demand for the transportation of supplies, such as fuel and food, as well as other tourist needs.

With respect to visitor satisfaction ratings, a decline was recorded in all of the ratings analyzed (Figure 2).

The impact of the drought was most noticeable for the "canoe tours" and "wildlife observation" items (Table 3).

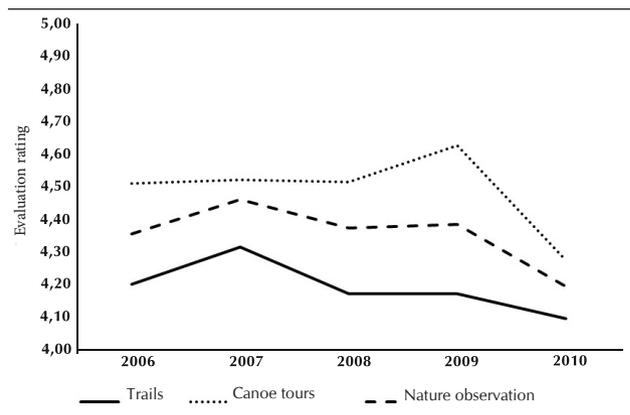


Figure 2 - Visitor satisfaction in the 2nd semester from 2006 to 2010.

Canoeing activities were restricted to a few areas in the ecotourism zone during the drought period since access to the commonly used canals was blocked. This shortened the tours, and also reduced the variety of the areas visited.

The drought caused restricted access to Mamirauá Lake for one month, which contributed to the drop in the item 'wildlife viewing'. This item was impacted because Mamirauá Lake is one of the principle ecotourism attractions in the Reserve due to the abundance of caiman, fish and birds associated with aquatic environments. Moreover, during periods of drought, primates and sloths are also easily observed on the lakeshore.

Although the analysis shows no significant result for the transfer item, it is known that the impact existed since investments in boat upgrades had been made in the first half of 2010. Therefore, it can be confirmed that the negative variation found was due to the drought (and not to factors related to vessel quality). The low water levels strongly limited access to the ecotourism area, where the route Tefé-Lodge-Tefé which under normal conditions lasts 1 hour and 30 minutes, lasted on

average around two and a half hours. In addition, visitors needed to leave the vessel and walk for about 20 minutes on a makeshift trail.

Regarding the densities observed for the primate *S. vanzolinii*, a significant increase was noted for these on the ecotourism trails. The results showed larger values for the species in the drought of 2010, indicating that the severe drought did not affect their detection (Figure 3).

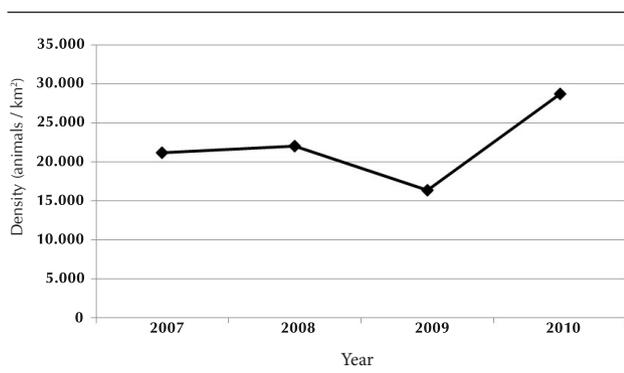


Figure 3 - Density of *Samiri vanzolinii* (Animals/km<sup>2</sup>) on ecotourism trails.

The densities of mammals, such as primates, may be influenced by a number of variables, both biotic and abiotic; however, these were not measured. It is possible that the extreme drought had affected the availability of resources in the study area for these primates, making groups more cohesive and consequently increasing the probability of individuals being detected.

In regards to tourist numbers over this period, it was not possible to analyze the variation because this aspect was heavily influenced by other external factors. The results show strong oscillations in the flow of tourists between all the years analyzed. This was due to the fact that the enterprise was going through a process of re-entering the market due to the closure of the airport in the city of Tefé

in 2006 and at the beginning of 2007. The low performance recorded for 2010 can also be related to an unfavourable environment for international tourism due to the overvaluation of the Real (see exchange in Table 2), and the global economic scenario that was already shaken by the beginning of the crisis in the Eurozone (JANÉR, 2011).

When analyzing the number of tour package cancellations - significantly higher when compared to 2009 - it can be inferred that the drought of 2010 contributed to this decline. Most of the cancellations were made by operators who had pre-reservations for the period. Thus, it is likely that the severe drought (well publicized by the media) discouraged travel agents from selling destinations located in more remote areas of the Amazon (like the Middle Solimões).

#### FINAL CONSIDERATIONS

The analysis suggests that the evaluated indicators were impacted in different ways by the extreme drought of 2010. With respect to operational costs, the incremental increase in fuel expense was evident while not affirmed for other items. The visitor satisfaction indicator showed more striking impacts on the items of wildlifeviewing, canoe tours and transfer service.

Regarding the primate density of *S. vanzolinii* on the ecotourism trails, the analyses do not indicate that the extreme drought of 2010 hampered the presence of squirrel monkeys.

Data also suggest that the 2010 drought may have contributed to some extent to the drop in visitor influx in the Reserve, possibly due to some tour operators feeling insecure about selling the destination. This is explained by the unusual number of tour package cancellations, precisely during the period of the extreme drought in 2010.

It can be affirmed that the isolation factor of Mamirauá consists of both a unique aspect in the ecotourism market (as it is one of the trip motivators for ecotourists) and a challenge with regards to the management of extreme events, such as the drought of 2010.

Therefore, the management team of the enterprise should be aware of the challenges inherent in events of this nature and outline in advance strategies that will minimize the economic and financial impacts which result from these events.

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