

Environmental fragmentation in the Morro do Diabo State Park in Teodoro Sampaio, SP, Brazil

Fragmentação ambiental no Parque Estadual do Morro do Diabo em Teodoro Sampaio, SP, Brasil

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ABSTRACT

Anthropogenic action can cause pollution, depredation and deforestation, leading to interference with biodiversity, ecological balance, and environmental impact and damage. We chose to study the Morro do Diabo State Park (MDSP) in Teodoro Sampaio-SP. This article aims to make an historical analysis of the public policies that determined the formation of the territory in the municipality and the environmental impacts caused since the legalization of the MDSP from 1941 to 2006. We used a qualitative-quantitative approach, for the construction of the linear history of environmental impacts in the Park. We verified that there was a gradual territorial loss of 9.31% corresponding to 3,311.35 hectares during the 65-year-period analyzed and that the main environmental damage was the implantation and construction of the Hydroelectric Plant of Rosana, which caused the deforestation of about 5.53% of the total area.

Keywords: Morro do Diabo State Park; Anthropogenic Action; Environmental Damage.

RESUMO

A ação antrópica pode causar a poluição, a depredação e o desmatamento, ocasionando interferência na biodiversidade, no equilíbrio ecológico promovendo o impacto e o dano ambiental. Portanto, para discutir esta questão, foi escolhido como objeto de estudo o Parque Estadual do Morro do Diabo (PEMD) no município de Teodoro Sampaio-SP. Este artigo tem como objetivo fazer uma análise histórica das políticas públicas que determinaram a formação do território no município e os impactos ambientais causados desde a legalização do PEMD, de 1941 a 2006. A pesquisa teve abordagem quali-quantitativa, para a construção da história linear dos impactos ambientais no Parque. O que se verificou com a pesquisa é que houve uma perda gradativa territorial de 9,31% que corresponde a 3.311,35 hectares dentre os 65 anos que compõe este estudo, e o principal dano ambiental foi à implantação e construção da Usina Hidrelétrica de Rosana, que ceifou cerca 5,53% da área total.

Palavras-chave: Parque Estadual do Morro do Diabo; Ação Antrópica; Dano Ambiental.

1 INTRODUCTION

State park is the name given to conservation units of integral nature protection belonging to the category “national park” from National System of Nature Conservation Units and plays a role of preserving natural ecosystems with great ecological relevance. Morro do Diabo State Park (MDSP), belongs to Teodoro Sampaio city (São Paulo state) and has a territory of 33,845.33 hectares whose administration is responsibility of Forestry Institute, agency of the State Secretary of State for Environment of São Paulo state. The site is extremely relevant because its fauna is diversified with presence of endangered species (“micoleão-preto”, black lion tamarin) and existence of Atlantic Forest and Cerrado biomes. MDSP is used by the regional population to carry out various activities, such as: scientific studies, ecotourism, extreme sports, among others, thus favoring human contact with environment, in order to develop environmental awareness.

The PEMD has suffered numerous impacts since its inception in 1941, many of them caused by anthropogenic action. Human activities can cause pollution, depredation and deforestation, causing interference in biodiversity, ecological balance and promoting results such as environmental impact and damage. To talk about the environment is to give rise to historical concerns that are neither too socio centric nor definitively determined, but that recognize importance of studying the relationships of the human element with the surrounding environmental conditions, including the reciprocal and non-equivalent determinations between anthropogenic factors and factors related to the environment, natural or not (BANDEIRA, 2007).

Thus, various agroeconomic cycles have marked development of the region during the last decades. PEMD was, and still is, the scene of several anthropic activities and represents an important milestone for numerous impacts that have occurred in the region.

Coelho (2001) considers that environment is a human and historical construction, product of a complex interaction between society and nature. Therefore, the idea of environmental impact as environment loads a plurality of interpretations, according to formation or objective of the researcher.

The region is a natural, political, technical and cultural space. And to think the region, it is necessary to surpass the pure material given, the natural landscape, in the direction of the lived space. The region needs to be seen as an open and moving totality, crossed by flows of energy, materials, assets, living beings, ideas, interests, powers. The clipping of the region needs to take into account the totality of the segmented space and set the level at which space fracture, as well as the variables that will control the space fractionation (MARTINS, 2007).

In a logical analysis, society is the environment, just as the environment is society. This premise, environmental issues are issues of citizenship, rights, which should be given priority in the concern of nature impoverishment, and incorporate social issues of poverty, marginalization and exclusion. Similarly, environmental history has to overcome social barriers and come to realize that environment is the result of political, economic, cultural, religious and social decisions and actions.

Global crisis and environmental movements were born in a time of reevaluation and cultural reform, on a world scale. This crisis was much smaller than the Great Depression (1929 crisis), but was responsible for forwarding the Bretton Woods system to collapse, thereby triggering a neoconservative financialization (BRESSER-PEREIRA, 2010). And this crisis has full influence on meetings in Stockholm (1972) and Rio (1992), because it gives rise to the notion that development has, besides an environmental restriction, a social dimension.

“Such a conception of the idea that poverty is a provider of environmental damage, thus sustainability should contemplate the social equality, life quality of this and future generations” (NASCIMENTO, 2012, p.51).

According to Drummond (1991), environmental history is therefore a field that summarizes many contributions and the practice is inherently interdisciplinary, linking multiple variables.

Even conducted under the aegis of multi-causality and the interdependence between different processes, these research efforts run into ambiguities and theoretical difficulties are far from being resolved due to their complexity.

Every work of the environmental historian must shift the analysis to the domain of territoriality, or rather spatiality (...) which brings to the discussion the categories of “space” and “region”, categories that should not be seen as previous definitions of geography to establish the clippings of the environments that one wishes to study (MARTINS, 2007. p 39)

Therefore, the work is based on some questions: What human actions have caused more impacts to the Morro do Diabo State Park? What historical period was this impact more relevant? How did the development history of the Teodoro Sampaio city? The hypothesis adopted is that the PEMD suffered environmental impacts considered serious, which caused irreversible environmental damages.

Therefore, this article aims to perform a comparative and temporal analysis of the anthropic action in relation to environmental impacts and damages in the Morro do Diabo State Park (PEMD). The construction of the historical analysis begins with the foundation of the Forest Reserve of Morro do Diabo on October 29, 1941 and includes until the last territorial delimitation of the PEMD in 2006 (65 years), presenting the human actions, impacts and damages occurred on the site and its consequences.

2 METHODOLOGICAL PROCEDURES

Methodological procedures used consisted in the organization of an aggregated database, from a reading and analysis of press clippings, reading and discussion of national historiography work, and History theory and methodology.

The focus for the study was the Pontal do Paranapanema Water Resources Management Unit, UGRI 22, focusing the city of Teodoro Sampaio-SP. UGHRI 22 is defined by the Pontal do Paranapanema basin in compliance with CHR decision nº 62 of September 4, 2006 and bases the River Basin Plans of the state of São Paulo. Design constitute one of the most important management instruments to be used by the Watershed Committees, which was carried out based on planning the information of the physical, economic and environmental partners.

The period rated for the study was from 1941 to 2006, looking for a critical view on the environmental impacts caused in the Morro do Diabo State Park. For a more particular view of Teodoro Sampaio-SP, methodological procedure adopted was the critical appraisal of sources and documents, and collection of regional newspapers.

For an understanding of environmental historical process in Teodoro Sampaio, a survey was done of its formation by oral search (vocal, unwritten): conversations and informal interviews with the first inhabitants of the region. For Alberti (2004, p. 23), oral history is the “recovery lived, conceived by those who lived”, allowing to recover that which is not found in other types of documents. We interviewed some of the former residents of the city using as oral history techniques, interviews were conducted in February 2016.

A cross-section of historical data (political-administrative, economic, social and cultural), quantitative and qualitative, was used to construct the linear history of the environmental impacts in PEMD, as well as the design of tables, graphs and human action (cause, reason) and the damages caused by it (effects) of the period of 65 years that this study refers (consequence).

Statistical analysis was based on data, information, and knowledge made available by several authors. They presented numbers, statistical numbers and percentages of environmental damage and impacts from the years 1941 to 2006, which correspond to the loss of vegetal cover and / or territorial extent. In this study, the following terms were used: Absolute Territory (representing the initially demarcated area of PEMD) and Resulting Territory (representing the area resulting from a given impact caused by anthropogenic action).

2.1 STUDY OBJECT

The PEMD is located in the extreme west of São Paulo State, a region known as Pontal do Paranapanema, in Teodoro Sampaio city. This region belongs to UGRHI 22 (Water Resources Management Unit), delimited with the geographic coordinates 21°43'58"S and 22°41'49"S, 50°58'59"W and 53°08'59"W, the south limits are Paranapanema River, the north limits are until UGRHI "Peixe", the west limits are Paraná River and the east limits are UGRHI "Médio Paranapanema". Figure 1 represents the geographic space of Pontal do Paranapanema, defined by UGRHI 2.



Figure 1. Pontal do Paranapanema map: Delimitation of UGRHI 22.

Source: IBGE (2016). Elaborated by the author.

Morro do Diabo State Park is located in the southwest region of São Paulo state, presenting exactly the geographical coordinates 22°27' - 22°40'S and 52°-52°22'W, in Teodoro Sampaio city, and is considered as the last reserve of the Semidecidual Seasonal Forest and Atlantic Rain Forest of São Paulo state. The park in question has a territory of 33,845.33 hectares. The Park administration is responsibility of the Forest Institute, a State Department of Environment agency (TORRES, SILVA JUNIOR, 2010), according to Figure 2.

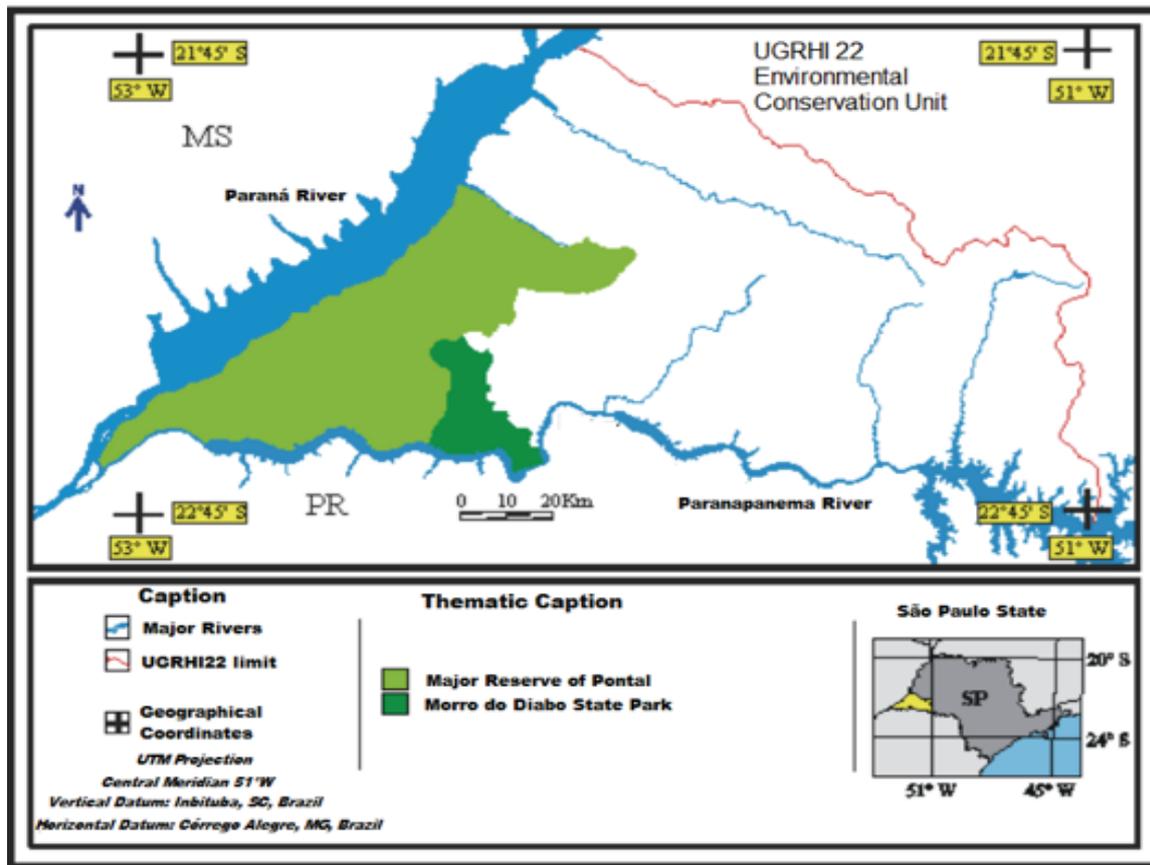


Figure 2. Location of Morro do Diabo State Park - PEMD.

Source: Menegette(2001).

The park has an imposing hill of 599.5 meters (388 meters altitude), with of Atlantic Rain Forest and Cerrado biomes features, being natural refuge of animals such as: jaguar, tapir, jaw and the symbol animal of São Paulo state, which provided the creation of the State Park on June 4, 1986, the black-lion tamarin (“Mico Leão-Preto”).

Thus, on 16 June 2002, a Decree of the Presidency of the Republic created the “Mico Leão-Preto” Ecological Station, ESEC-MLP, with an area of 6,670 hectares and a perimeter of 91 km, for full conservation and preservation of this and other species. All this area is not part of the described Park areas, as well as its visitation is restricted to researchers and residents of surrounding areas (MMA, 2008).

3 HISTORY OF THE ENVIRONMENTAL IMPACTS AT MORRO DE DIABO PARK

The main environmental impacts and/or damages are qualified in the study as “Political-economic interferences”. In PEMD interferences are caused in favor of economic interests, which have been defined by Municipal, State and Federal Laws and Decrees, presented: Deforestation Actions (1962-1975); Sorocabana S.A. Railway construction in Teodoro Sampaio-SP (1960), sugarcane production expansion (1970 and 2007); Rosana Hydroelectric Power Plant construction in Rosana-SP (1980-1987); Arlind Bettio Highway (SP-613)construction (1970) and Teodoro Sampaio Municipal Airport construction (1978). “Social Interferences”: Interferences provoked by the pursuit of social equity (Influence of Agrarian/Agricultural/Land Reform) and “Accidental Interferences”: Interference of uncontrolled human action (Fires and road kills of wid life).

It is interesting to say that many of the impacts highlighted above have been implemented by the state and should be understood as public policies. They helped to structure the territory and should be understood as the social forces present in the historical formation of Teodoro Sampaio city, outlining its use.

Many studies have highlighted the relation between politics and territory, emphasizing that all political decisions have a clear repercussion on the territory (SANTOS, 1998). Public policies play an important role for organizing/managing and planning the territory (SOUZA, 2006; MELAZZO, 2010). According to Santos (2009) every action on the territory contains an intentionality reveal purpose, a conscious and voluntary movement involving different agents, expressed in strategies of action, practices and discourse. Thus, state action, motivated or not by the demands of organized civil society, must be understood as public policies.

Public policies are, first of all, negotiated conflicts, regulated by political institutions of various types, conditioned by mediations that make it possible to reduce antagonisms and design them in a positive movement, at least apparently positive (ABRANCHES, 1987, p. 10).

Most of the policies implemented in the region came to benefit and regularize the actions for real estate speculators, politicians, among others, mainly regarding the land occupation and the destruction of the great forest reserves that existed here.

Deforestation process occurred in the city and described by the testimony of Mr. José Adalgísio Moreira in an interview (2016), which shows his indignation at observing the lumbering of hardwood forests:

The forest was largely destroyed to give way to several crops (cotton, coffee and peanuts), as well as for the formation of Teodoro Sampaio city. This was increasing as the surrounding woods were slaughtered. "(Testimony [April 2016] by José Adalgísio Moreira, interviewer Marta Moura, Teodoro Sampaio, 2017. audio recording interview. interview granted to research).

Sorocabana Railroad construction in Teodoro Sampaio-SP was responsible for the deforestation that caused impact and direct damages to the biodiversity present in Forest Reserve of Morro do Diabo. The Forestry Institute (2006, p.83) indicates the causes and numbers impacts of the railroad construction:

Although the rails of a railroad occupy little physical space, the felling of the forests inside the Reserve of the Morro do Diabo surpassed by more than 100 meters in the lateral ones, subtracting about 200 ha of its area. It must be kept in mind that the railway sleepers, were manufactured using wood from this and other region.

The political-economic benefits generated by the railroad were not constituted for a long time, since in 1978, passenger trains were suppressed and freight trains still resisted while traveling to Euclides da Cunha for another two years, so in 1980 the transport in Teodoro Sampaio came to an end (CABREDO, 2001).

Another agricultural activity that produced deforestation and major environmental impacts was sugarcane production. Thus, Nogueira (2009, p.36) cites the introduction of sugarcane in Teodoro Sampaio since the 1970s, with the implementation of the Aliança Distillery:

The arrival of the sugarcane once again moved this scenario. A large power plant had been active in the region since the 1970s, but the decline in fuel alcohol consumption in the next decade prevented farming from becoming dominant there. Everything changed from 2003 to here, due to the emergence of flex-fuel cars and the stimulus of government in the sector.

Sugarcane was implanted in Pontal do Paranapanema as a "mitigation tool" for the impacts and damages caused by the construction and inundation caused by the hydroelectric power plants in the region (FERREIRA JÚNIOR; HESPANHOL, 2006).

Among the three hydroelectric power plants built in the Pontal do Paranapanema, the most damaging and still damaging impacts of the PEMD is the Rosana Hydroelectric Power Plant, located on the Paranapanema River, between the cities of Rosana-SP and Diamante do Norte-PR. The works began in 1980, starting operations in 1987, under the responsibility of CESP – Companhia Energética do Estado de São Paulo (São Paulo State Electric Company) (BORELLI et al., 2006).

Another anthropic action that caused and still causes immense environmental impacts in PEMD, as well as promoted the so-called regional “progress and development” was the implementation of a Highway, named as Arlindo Bettio (FREIRE, MELLO, ARAÚJO AND GONÇALVES, 2011). Already, in 1978, the São Paulo state Governor Paulo Salim Maluf authorized the construction of a municipal airport, seeking to facilitate work operations of the hydroelectric power plants, providing the use of 15 hectares to Teodoro Sampaio municipal government, according to Decree n° 14.649/1979 (SÃO PAULO, 1979 apud IF, 2006, p.85). However, this area was expanded to 35 hectares by Law n° 2.539, November 11, 1980 (SÃO PAULO, 1980 apud IF, 2006, p.85).

The struggle for land in Teodoro Sampaio was marked by the first occupation in the region, precisely at Fazenda Nova Pontal, which was considered as the beginning of the rural territorial contestatory process (FERREIRA JÚNIOR; HESPANHOL, 2006). The struggle for land gave rise to the first land reform settlement in the region, entitled “Gleba XV de novembro”. This settlement is a direct result of labor and land reclamation movements. The history of “Gleba XV de novembro” is summarized as originating from the government measures implemented to mitigate and alleviate the conflicts between peasants and large landowners in Teodoro Sampaio city (ANTÔNIO, 1990, p.47-48 apud FERREIRA JÚNIOR; HESPANHOL, 2006, p.7).

Settlements are created through the state (re)incorporation of vacant lands, in other words, lands considered by the Justice and the Government illegal target “grilagem” or of exclusive dedication to the livestock management, considered like unnecessary immense territory only for the cattle raising extensive. And, by ironic twist of fate, these areas generally coincide with forest fragments in Pontal do Paranapanema, areas that shelter endangered species, such as the black-lion tamarin, the jaguar and the tapir.

An example of this situation is Santa Teresinha da Alcídia State Settlement, which was created in 1998, with a total area of 1,345 hectares, consisting of 26 (twenty-six) plots, of which 24 (twenty-four) signed a contract with Sugarcane power plant for the sugarcane cultivation, representing an adherence of 92.31% of the lots (VERGES, 2013, p.73).

The settlement cited was created with the purpose of reducing agrarian conflicts in the Pontal do Paranapanema region, as well as promoting Agrarian Reform and providing economic growth, but it is agreed that agrarian conflicts are reduced with territory concessions, while in this situation environmental conflicts arise, it means: human occupation (settlement) versus conservation and preservation of forest fragments and all their biodiversity.

Conflicts in the region forced the State to create structures to respond to the new demands imposed; creating through Decree 33.133 / 1991 the Institute of Land of São Paulo state (ITESP) and in 1995 was created the Government Action Plan for Pontal do Paranapanema. Teodoro Sampaio city had, from 1988 to 2005, 20 settlements with an area of 22,694.43 hectares with about 480 resettled families. According to Leal (2003) settlements have caused socio-territorial impacts in the region, derived from changes in the management practices and natural resources conservation, from a more rational and sustainable way of producing which is the family agriculture or family farming.

Thus, it should be underscored that the family income of coastal residents became fully committed due to flooding promoted by the construction of the hydroelectric plant of Rosana thus the sugarcane crop in the region again, because of government subsidies and allowing support to river dwellers affected by this great environmental impact

Thereby, it should be underscored that the family income of coastal residents became fully committed due to flooding promoted by the construction of the hydroelectric power plant of Rosana, thus, sugarcane crop returned in the region, due to the government subsidies and enabling sustenance riverine communities affected by this huge environmental impact. But sugarcane production gained more prominence and space in the region during the 2000s, due to the government’s incentive to create bi-fuel cars (gasoline and ethanol), thus, the market needs more ethanol and it is up to agribusiness to produce more sugarcane.

Between 1963 and 1991 the Reserve and Park suffered from several fires, some with records of vegetation cover losses, such as: in 1973 the estimated loss was at 180 hectares resulting in a vegetation cover reduction of 0.49%; in 1975 the loss of 150 hectares, estimated at 0.27%. In 1979 the largest recorded fire occurred, with a decrease of 267 hectares, representing 0.7% forest area reduction; and in 1991 another fire led to a reduction of 160 hectares, estimated at 0.46%. In other years (1963, 1968, 1973, 1974 and 1976) the fires were reported and identified as occurrences, however, no author cited numbers, percentages, or at the time that these fires occurred there were no accurate analysis of territorial scale and the relative vegetation cover losses. Thus, resulting in damage to local biodiversity studied, ie, there are no accurate data and statistical evidence for an extent of damage interpretation (IF, 2006).

The Arlindo Bettio Highway (SP-613), is also a direct cause of fires, due to the lack of education of drivers and their passengers for throwing objects such as: glass, plastic, metal and cigarette butts, which in drought periods can cause fire principles and by fire sequence.

Another environmental impact with several occurrences in the PEMD, in which it can be considered of accidental order, is the trampling, road kill wild life. The opening of a road causes numerous impacts, as well as resulting in several problems that the surrounding highway environment begins to suffer, causing environmental damages against the biotic integrity of both terrestrial and aquatic ecosystems, causing: changes in animal behavior, change in the movement patterns and reproductive success, ecological imbalance, food chain modifications, disease spread, predatory hunting and fishing, border effect, population isolation, among others (TROMBULAK; FRISSEL, 2000 apud FREIRE; MELLO; ARAÚJO; GONÇALVES, 2011, p.91-92).

From 1994 to 2000, 22 jaguars were hit on the highway already mentioned, this number drops natural deaths and felines not found. In 1997, the program entitled Ecological Detective program, directed by the Institute of Ecological Research (Ipê) was implemented, in which it monitored 20 animals, among jaguars and ocelots, of the total of 6 (six) jaguars, 4 (four) were killed, corresponding to 65% of the jaguars (CULLEN JR., 2001). Table 1 presents quantitative and percentages resulting from the comparative relationship between the PEMD territorial loss types and its impacts.

Table 1 - Comparative Analysis of the Territorial Loss of PEMD.

DATA	FACT	TERRITORY ABSOLUTE	IMPACT AND/OR DAMAGE	TERRITORY RESULTING	%	SOURCE
29/10/1941	Foundation of the Forest Reserve	37.156,68 ha	----	37.156,68 ha	100 %	Leite (1998); Souza (2002)
1950	Railroad	37.156,68 ha	- 200 ha	36.956,68 ha	- 0,54%	IF (2006)
1963	Fire	36.956,68 ha	Sem registro	36.956,68 ha	----	IF (2006)
1968	Fire	36.956,68 ha	Sem registro	36.956,68 ha	----	IF (2006)
1970	Highway	36.956,68 ha	- 70 ha	36.886,68 ha	- 0,19%	IF (2006)
1973	Fire	36.886,68 ha	- 180 ha	36.706,68 ha	- 0,49%	IF (2006)
1974	Fire	36.706,68 ha	Sem registro	36.706,68 ha	----	IF (2006)
1975	Fire	36.706,68 ha	- 100 ha	36.606,68 ha	- 0,27%	IF (2006)
1976	Fire	36.606,68 ha	Sem registro	36.606,68 ha	----	IF (2006)
1978	Airport	36.606,68 ha	- 35 ha	36.571,68 ha	- 0,09%	São Paulo (1979 <i>apud</i> IF; 2006, p.85)
1979	Fire	36.571,68 ha	- 267 ha	36.304,68 ha	- 0,7%	IF (2006)
1980 to 1986	Construction of Rosana UHE	36.304,68 ha	-1.944,06 ha	34.660,62 ha	- 5,53%	Rezende (2014); Souza (2002); Borelli et al. (2006, p.22)
04/06/1986	Creation of the Forest Park	34.660,62 ha	+80,46 ha	34.441,08 ha	+0,23%	Rezende (2014)
1989 ou 1991	Fire	34.441,08 ha	- 160 ha	34.281,08 ha	- 0,46%	Souza (2002); IF (2006)
1994	Definition of Varjão	34.281,08 ha	- 250 ha	34.031,08 ha	- 0,73%	Souza (2002)
2006	Last Definition of Territory	34.031,08 ha	- 185,75 ha	33.845,33 ha	- 0,54%	Souza (2002)
TOTAL	----	37.156,68 ha	- 3.311,35ha	33.845,33 ha	- 9,31%	----

Source: Author (2016).

Through the Descriptive Statistical Analysis the territorial reduction and/or loss during the 65 years analyzed was observed. The State Park of Morro do Diabo lost about 9.31% (3,311.35 hectares) of its territory, that is, of the 37,156.68 hectares decreed on October 29, 1941, remaining in the last territory definition (in 2006) about 33,845.33 hectares. Recalling that there were several fires in the years 1963, 1968, 1974 and 1976 that were historically recorded, however, at the moment of the occurrence the vegetation loss percentages or amounts were not raised, thus it is conceived that the loss percentage is much higher than that reported.

Anthropogenic action led to several impacts, including: railroad construction (1950), Fires (1963 to 1991), Highway construction (1970), Airport construction (1978) and Rosana Hydroelectric Power Plant construction (Rosana UHE) (1980 to 1986). With these definitions it is possible to temporarily delimit the decades and the human actions that most affected the object of this study. Thus, the following Table 2 was constructed and analyzed.

Table 2 - Human Actions between the Decades 1950 and 2000.

HUMAN ACTION	DÉCADE	Nº OF OCCURRENCES	TERRITORIAL LOSS	%
Railroadconstruction	1950	1	200 ha	0,54%
Fires	1960	2	Sem registro	Sem registro
Highwayconstruction	1970	1	70 ha	0,19%
Fires	1970	5	547 ha	1,46%
Airportconstruction	1970	1	35 ha	0,09%
Rosana Hydroelectric Power Plantconstruction	1980	1	1.944,06 ha	5,53%
Fires	1980	1	160 ha	0,46%
Definitionof Varjão	1990	1	250 ha	0,73%
LastDefinitionofTerritory	2000	1	185,75 ha	0,54%
TOTAL	1950 – 2000	14	3.391,81 ha	9,54%

Source: Data adapted by the author (2016).

It was possible to observe 14 occurrences of human action, totaling a territorial loss of 3,391.81 ha, corresponding to 9.54% of the entire territory studied. These figure also do not correspond to Table 2, however, it should be noted beforehand that these are the total numbers of the loss, without considering the territorial demarcation carried out on June 4, 1986, which increased the territory by 80.46 hectare, which corresponds to 0.23% of the total. In order to understand and analyze these data, Table 3 is presented.

Table 3 - Human Action on Absolute Values.

HUMAN ACTION	TERRITORIAL LOSS	%
RailroadConstruction	200 ha	5,90%
Fires	707 ha	20,84%
ConstructionoftheHighway	70 ha	2,06%
Airportconstruction	35 ha	1,03%
Rosana Hydroelectric Power Plantconstruction	1.944,06 ha	57,32%
Definitionof Varjão	250 ha	7,37%
LastdefinitionofTerritory	185,75 ha	5,48%
TOTAL	3.391,81 ha	100%

Source: Data adapted by the author (2016).

Through these analyzes and statistical data a Historic Line was constructed between the periods of October 29, 1941 (Creation of the Forest Reserve) and 2006 (last definition of the PEMDtotal are), in order that, a more didactic-pedagogical way, to understand how human actions may have interfered in the studied environment, as well as, be able to differentiate periods or decades with their impacts/damages (Figure 3).

Analyzing Figure 3, it can be seen that throughout this study only a single occurrence of a territorial increase was registered, precisely on June 4, 1986 with the creation of the State Park. Also in this same year was the worst environmental damage caused by public policy actions, with a significant loss of 1944.06 hectares, estimated at 5.53%, due to the construction of the Rosana UHE.

In Figure 4, Teodoro Sampaio city territorial growth relation can be noticed. To understand this “territorial growth” of Teodoro Sampaio city data were grouped for decades (1940 -2016)(Table 4).

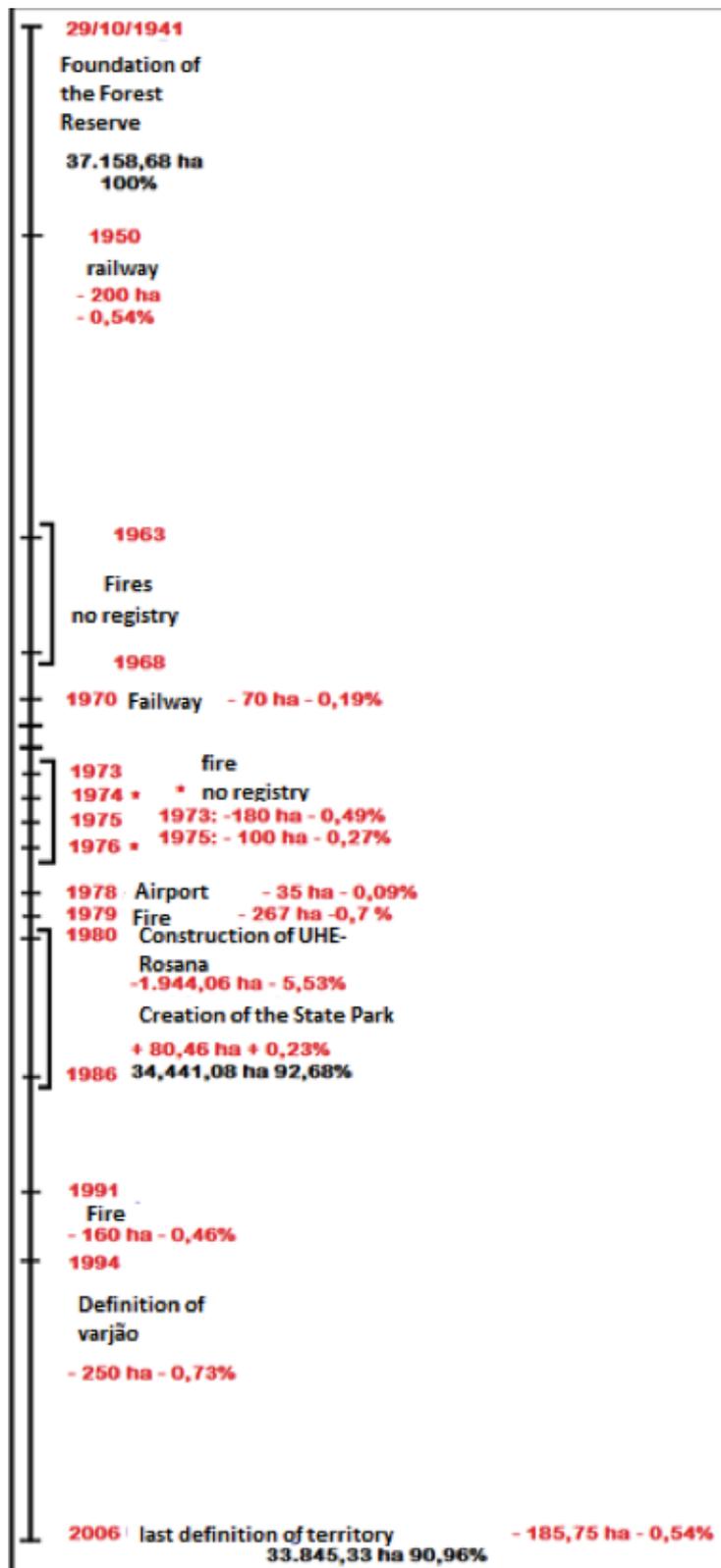


Figure 3 - Historic Line (1941 to 2006).

Source: Data adapted by the author (2016).

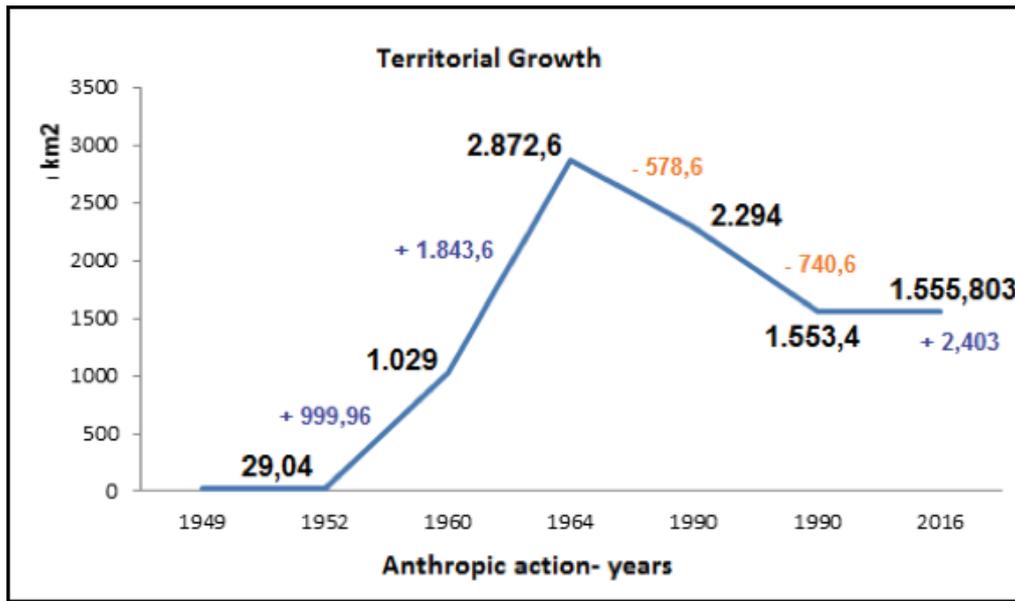


Figure 4 - Territorial Growth of Teodoro Sampaio (1949 - 2016).

Source: Prepared by the author (2016).

In the conception of this study, the Historical Linearity analysis was the best alternative to narrate, describe and compose the environmental impacts and their possible consequences. Therefore, by a historical sequence it can be assimilated that, in the case of Teodoro Sampaio city, the territorial increase was giddy since 1949, when it was still regarded as Vila, possessing a territory with about, 29,04 km², even with regional districts losses Rosana and Euclides Da Cunha, the sum of regional gain reaches 1526.76 km², representing an “spatial growth” of 5.397%.

Table 4. Territorial Analysis of the city by Decades - 1940 to 2016.

DECAD E	TERRITORY ABSOLUTE	GAIN TERRITORIAL	TERRITORIAL LOSS	%
1940	29,04 km ²	29,04 km ²	-----	100 %
1950	29,04 km ²	-----	-----	100 %
1960	1.029 km ²	999,96 km ²	-----	+3.443,38%
1960	2.872,6 km ²	1.843,6km ²	-----	179,16%
1990	2.294 km ²	-----	- 578,6 km ²	- 20,14 %
1990	1.553,4 km ²	-----	-740,6 km ²	- 32,25 %
2016	1.555, 803 km ²	2,403km ²	-----	+0,15 %
TOTAL	1.555,803 km²	2.875,003 km²	1.319,2 km²	- 45, 88%

Source: Data prepared by the author (2016).

However, performing an analysis of “Absolute Territorial Growth” in reality the city in question obtained “Territorial Loss”. Recalling that Teodoro Sampaio already had a territory of 2,872.6 km² and lost the districts already mentioned, thus adding a reduction of 1,319.2km², totaling a 45.92% decrease in the territory, that is, the 1,555,803 km² correspond to 54.08% of the territory it owned in 1964.

PEMD had a clear reduction of 9.54% of its absolute territory, which corresponds to a total of 3,391.81 hectares. However, as in 1986 there was a territorial “increase” of 80.46 hectares, the percentages changed to a reduction of 9.31% with a loss of 3,311.35 hectares

Thus, comparing territorial losses and gains of the PEMD and Teodoro Sampaio city, it was noticed that the city gained about 46.10 times the total territory that the PEMD lost, that is, assessing the data, Teodoro Sampaio gained 1,526,763 km², while the PEMD lost 3,311.35 hectares. Thereby, it is verified in this study that the city territorial gain was not able to provide increase of areas, preservation spaces, conservation and/or areas of vegetation cover for the PEMD.

Analyzing a measure to mitigate the impacts in this study described, as well as, prevent/decrease the emergence of new impacts will be to consider the Tax on Goods and Services (ICMS) as a mediator and protector of the environment. Therefore, giving credibility to those exposed by Petry (2009, p.49):

Such recognition is of paramount importance residing here other capabilities that has the ICMS as an instrument of environmental policy. It is understood that the potential of the tax as an instrument to protect the environment, in light of, goes beyond the use of traditional tax incentives aimed at changing the behavior of producers, and it can also be used as a tool of policies to induce environmental behavior in consumption.

Petry (2009, p.50) continues to describe the ICMS serves as a tool for preventive environment protection, which considers as fair the linkage of the tax with the principles of precaution and prevention. Such use of ICMS serves as environmental preservation tool before being (more) affected by human actions, thus, bypassing the single use of compensatory measures of damages, which are important, but should not be.

On average, the transfer of ICMS is 25% of revenues, which must be transferred from the state to cities that compose them. It was determined by the Federal Constitution of 1988 that 75% of this revenue (25%) should be distributed according to the added value generated in each city, and the remainder should be distributed according to the decisions defined by each state (FERNANDES; COELHO; FERNANDES; LIMA, 2011).

Law n° 8,510 of December 29, 1993, establishes the Ecological ICMS, i.e. a part of the ICMS should be directly allocated to the protection, defense and preservation of the environment. Thus, according to São Paulo (1993) in its Article 1°:

VII - 2% (two percent), based on the result of the corresponding value of the division this percentage by the number of municipalities in the state on December 31 of the year preceding the calculation.

Paragraph 1. For the purposes of this law, it is considered own tax revenue and accounted for in the fiscal year prior to the calculation, coming exclusively from the taxes provided for in the Constitution of the Republic.

Paragraph 2. For the purposes of section VI, the total area considered as a specially protected territorial space in each city shall be the sum of the areas corresponding to the different conservation units present in the city, weighted by the following weights:

I - Ecological Stations - Weight 1.0 (one);

II - Biological Reserves - Weight 1.0 (one);

III - State Parks - weight 0.8 (eight tenths);

IV - Wildlife Areas in Environmental Protection Areas (ZVS in APA's) - weight 0.5 (five tenths);

V - Forest Reserves - weight 0.2 (two tenths);

VI - Environmental Protection Areas (APA's) - weight 0.1 (one tenth);

VII - Natural Areas “Tombadas” (protected as heritage) - weight 0,1 (one tenth).

According to the Department of Environment of São Paulo State (2016), Teodoro Sampaio city had transfer the Ecological ICMS in the following values as shown in Table 5.

As seen in Table 5, the last 10 years (2006 to 2016), Teodoro Sampaio city received a total of 20,144,146.50 transferred from the Ecological ICMS. But, in surveys conducted on the website of Teodoro Sampaio city (<<http://www.teodorosampaio.sp.gov.br/>>), no direct references of the pass-through and the subsequent use of these resources were found in the Transparency Portal. Therefore, with the absence of such information it is not possible to determine whether or not there were direct actions and investments in favor of environmental protection.

Table 5 -Transfer of Ecological ICMS to the city of Teodoro Sampaio - São Paulo in Years 2006 to 2016.

YEARS	VALUE IN REAL
2006	1.123.573,57
2007	1.196.476,8
2008	1.378.351,93
2009	1.393.266,01
2010	1.663.875,58
2011	1.963.860,38
2012	2.095.625,21
2013	2.385.722,10
2014	2.312.800,12
2015	2.393.207,32
2016	2.237.387,44
Total	20.144.146,50

Source: Brazil (2016).

Such resources can be decisive for protecting the environment, as well as improving and boosting the local economy, promoting reforestation projects, investing in environmental education programs, aiming to provide autonomy and food sovereignty to the populations living in areas surrounding environmental protection.

5 FINAL CONSIDERATIONS

Morro do Diabo State Park is the last remnant of the Semideciduous Seasonal Forest or Mata Atlântica (Atlantic) Rain Forest in São Paulo state, with predominant features of the Atlantic Rain Forest biome and some territories with Cerrado features. Currently it has a vegetation cover of 33,845.33 hectares.

Throughout the description of the historical linearity, which this research has dealt, it can be understood that interferences occurring in Morro do Diabo State Park brought impacts and damages that led to the loss of vegetal cover, corresponding to 9.54% (3,391.81 ha) of absolute territorial loss.

It is interesting to note that the change in Reserve status to Park status, for political, held by Decree N°. 25,342, dated June 4, 1986, brought a territorial increase of 80.46 hectares (0.23% of the total area). This increase was due to the preservation of the black-lion tamarin species, extinct until 1970.

In the comparative analysis exposed in these work, between the territorial scope of the Teodoro Sampaio city in relation to PEMD, it can be verified that the relative territorial increase of the city was not enough able to provide an increase of areas, spaces or territories of preservation and conservation in to PEMD.

Through the environmental impacts presented in the work, it was verified that the construction and implantation of the Rosana Hydroelectric Power Plant was the one most responsible for the impacts by the PEMD, due to the great flood area that removed about 5% of the total area and generated a radical biodiversity change. Also provoking changes of social order in the region, directly damaging riverside population life, which obtain their income through fishing and cultivating agricultural products.

This study corroborates the understanding of how the interferences related to public policies impacted and caused environmental damage in the MDDP and the Pontal do Paranapanema region. Thus, through interpretation of history, political, economic and social interference, territorial losses and biodiversity, it can be understood that the policies implemented in the region have benefited and regularized the human occupation process and resulted in irreversible environmental impacts.

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