

OCCUPATION IN THE ENVIRONS OF INDIGENOUS TERRITORIES IN RONDÔNIA, BRAZIL¹

A OCUPAÇÃO NO ENTORNO DAS TERRAS INDÍGENAS
EM RONDÔNIA-BRASIL

LA OCUPACIÓN EN LOS ALREDEDORES DE LAS TIERRAS INDÍGENAS
EN RONDÔNIA-BRASIL

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Abstract

Non-indigenous occupation of the Amazon has led to the suppression of indigenous lands, particularly in the Brazilian state of Rondônia. As a result, part of these territories is now indigenous reserves constantly under pressure from the economic activities that surround them. In this sense, the purpose of this study is to map and analyse the occupation of the areas surrounding indigenous lands in the state of Rondônia. To reach these goals, indirect methods of spatial analysis were applied: studies of orbital remote sensing images and map algebra. Research results reveal that the area studied amounts to 5,504,717.63 hectares, of which 1,438,577.46 hectares are employed for multiple uses, especially extensive cattle-raising activities. Among the 21 indigenous reserves studied, the River Omerê Indigenous Reserve contains the largest amount of anthropic area compared to its near surroundings, the total being 65.36%. It is followed by the Ribeirão and Lage reserves, at 52.56% and 50.34%, respectively. On the other hand, the area encircling the Rio Negro Ocaia Reserve is the most intact, with only 0.31% of deforested area. Furthermore, approximately 70% of the area studied revealed low Anthropic Pressure Index (API), while 3.54% had high API.

Keywords: Amazon Occupation, Rondônia State, Indigenous Reserve.

Resumo

A ocupação da Amazônia, especialmente em Rondônia, ocasionou a supressão dos territórios indígenas. Assim, parte desses territórios são as atuais terras demarcadas, que em muitos casos, encontram-se pressionadas pelas atividades econômicas que as envolvem. Desta forma, o presente trabalho tem como objetivo mapear e discutir as pressões da ocupação no entorno das Terras Indígenas no Estado de Rondônia. Para alcançar os objetivos propostos, aplicou-se métodos indiretos de análise espacial: análises de imagens de sensoriamento remoto orbital e álgebra de mapas. Os resultados revelaram que a área estudada soma 5.504.717,63 hectares, sendo que 1.438.577,46 estão comprometidos por usos múltiplos, em que destaca a pecuária extensiva. A Terra Indígena (TI) Rio Omerê é, dentre as 21 terras indígenas analisadas, a que apresentou maior valor de área antropizada do entorno próximo, um total de 65,36%, seguida das Terras indígenas Ribeirão e Lage, com 52,56% e 50,34%, respectivamente. Por outro lado, o entorno da TI Rio Negro Ocaia apresenta-se mais preservado, com apenas 0,31% da área desmatada. Além disso, aproximadamente

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70% da área estudada revelou um Índice de Pressão Antrópico (IPA) baixo, enquanto que 3,54% apresentou IPA Alto.

Palavras-chave: Ocupação na Amazônia, Rondônia, Terras Indígenas.

Resumen

La ocupación de la Amazonia, especialmente en el estado de Rondônia, resultó en la supresión de los territorios indígenas. De esa manera, parte de estos territorios son las actuales tierras demarcadas, que en muchos casos se encuentran presionadas por las actividades económicas que se desarrollan alrededor de las mismas. Así, este trabajo tiene como objetivo mapear y discutir las presiones de la ocupación alrededor de las Tierras Indígenas demarcadas en el estado de Rondônia. Para alcanzar los objetivos propuestos, se aplicaron métodos indirectos de análisis espacial: análisis de imágenes de teledetección y álgebra de mapas. Los resultados revelaron que el área estudiada suma 5.504.717,63 hectáreas, siendo que 1.438.577,46 hectáreas están comprometidas por usos múltiples, destacándose la ganadería extensiva. La Tierra indígena (TI) Rio Omerê es, de entre las 21 tierras indígenas analizadas, la que presentó mayor valor, un total de 65,36% del área del entorno impactada por actividades antrópicas, seguida de la Tierras Indígenas Ribeirão y Lage, con 52,56% y 50,34%, respectivamente. Por otro lado, el entorno de la TI Rio Negro Ocaia se presentó más preservada, con solamente 0,31% del área deforestada. Además de eso, aproximadamente el 70% de la área estudiada presentó Índice de Presión Antrópica (IPA) bajo, mientras que 3,54% tenía IPA Alto.

Palabras clave: Ocupación de la Amazonia, Rondônia, Tierras Indígenas.

Introduction

The non-indigenous occupation of the state of Rondonia was consolidated in the 1970s, especially with its integration into the national road network, in which BR-364 is the highlight, as it was along this highway that the distribution of lands throughout its length was brought into effect, with the consequent expansion of agricultural, livestock, logging and mining activities (Fearnside, 1980; INPE, 1992; Moran, 1993; Cim, 2003; GTA, 2008).

The consolidation of this occupation resulted in intense deforestation, which has contributed to the suppression of the territories of forest peoples and put their lands under pressure. According to Freitas (2009), the aforementioned occupation in the 1960s and 1970s was, predominately, a moment of extreme physical and cultural violence towards the various indigenous populations.

The removal of vegetation in Rondônia was at its peak in the 1990s and, until 2007, remained higher than in any other state of the Amazon (GTA, 2008). Thus, observing the date of the creation of new municipalities in Rondônia, it is possible to certify that it was also during this period that 29 of the current 52 municipalities were emancipated, and this may have contributed to the opening of new agricultural frontiers.

According to INPE (2015) the accumulated deforestation in Rondônia state by the year 2014 was 88,606.60 km², representing 36.86% of the state's total area. According to Fonseca et al. (2014), in May 2014, the vast majority (71%) of the deforestation occurred in private areas or those under some degree of ownership. In addition, according to the authors, 10% of this total occurred in Rondônia.

Thus, the removal of vegetation exposed the indigenous territories occupying 50,618.38 km², corresponding to 21.31% of the area of the state of Rondônia. According to the GTA (2008), indigenous territories in this state have been increasingly threatened by illegal deforestation. In fact, according to Freitas (2009), incentives were given in Rondônia, through the National Institute of Colonization and Agrarian Reform (INCRA), with the distribution of plots in indigenous territories.

Noteworthy is the fact that indigenous lands in Brazil have no defined buffer zones like the Protected Units that have surrounding areas as 'cushioning', in accordance with the Decree 99.274 / 90. Nevertheless, despite the indigenous territories not having a cushioning area, the Decree 7747 of 05/05/2012 that established the National Policy on Environmental and Territorial Management of Indigenous Land (PNGATI) reveals the need to promote preventive efforts and control of environmental disasters, damages, catastrophes, and emergencies in indigenous lands and their environs. It is also necessary to promote environmental and indigenous education activities within these lands. In this sense, the creation of ecological and ethno-environmental corridors between indigenous territories (ITs) is a way to minimize negative impacts on these lands (Gomide & Kawakubo, 2005).

Thus, the analysis of the occupation in the environs of ITs in the state of Rondônia is a necessary task, although a complex one, owing to the extensive territorial area and difficulties of access. Therefore, with the use of orbital images, we analysed the land uses that are established on the outskirts of ITs and attendant identified pressures.

Methodological procedures

There are 20 ITs in the state of Rondônia, 17 being entirely within the state area and three occupying territories in Rondonia and Mato Grosso states (Figure 1). The IT Zoró, although located entirely in Mato

Grosso, comprises the Tupi-Monde corridor and is connected to the lands of Rondônia. Thus, it was analysed accordingly.

The research was performed through indirect methods of environmental analysis, in particular by making use of satellite remote sensing imagery, which had the major advantage of synoptic vision of the environment. Thus, the uses of orbital images in the Amazon contribute to the discussion of human practices that endanger the regional socio-diversity in time and space. On the other hand, the methods of analysis of remote sensory images are diverse.

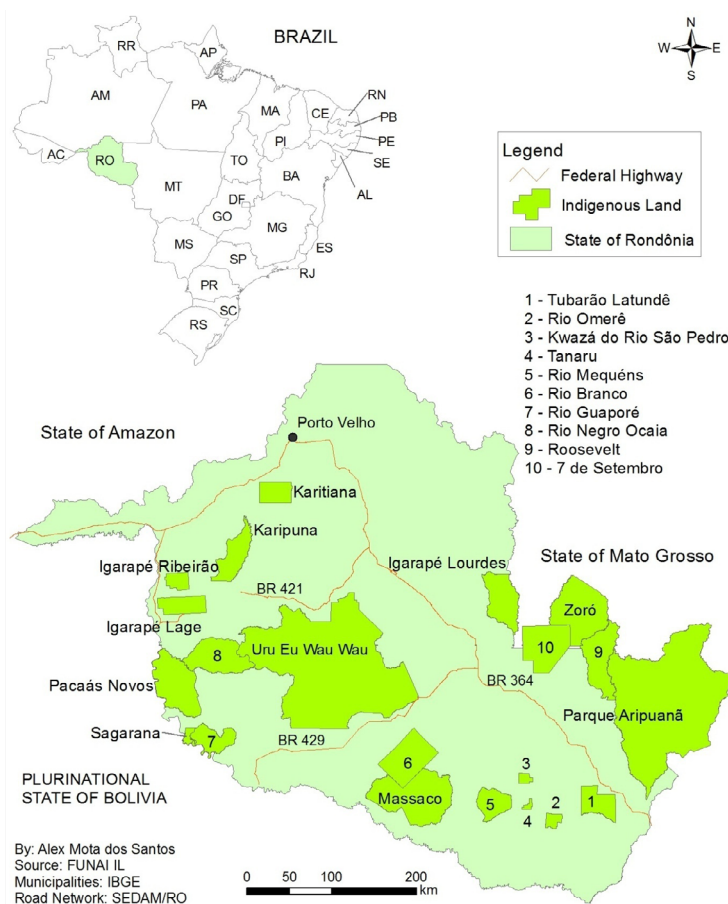


Figure 1 - Localization of indigenous territories in the state of Rondônia, 2015

According to Gonzalez and Woods (2000), the procedures that involved the analyses of orbital images can be grouped together into four basic stages, from the acquisition of data, its geometric and radiometric correction, to the processing and the analysis of the results. Thus, LANDSAT8, OLI sensor images of the 2013 dry period were acquired in order to avoid cloud interference. For this, 15 pictures were necessary, namely orbits-point: 001-066; 001-067; 229-067; 229-068; 229-069; 230-067; 230-068; 230-069; 231-067; 231-068; 231-069; 232-066; 232-067; 232-068 and 233-067. The images were corrected and processed in the Geo-referential Information System (SPRING) (Câmara et al., 1996), freely available from the National Institute for Space Research (INPE).

In this sense, a method of classification by region was employed, in which image labelling through the segmentation method was effected. In SPRING, for the process of segmentation, it is necessary to indicate a criterion of similarity for each pair of the spatially adjacent region. Thus, in this research, the similarity varied owing to the vast extensiveness of the area under study, from 800 to 2000 (non-dimensional).

Beginning with the labelled image, classification through the Bhattacharyya supervised method was applied. According to Câmara et al. (1996) the Bhattacharyya's distance measure is used in the region-based classifier to measure statistic separability between a pair of spectral classes, in other words, it measures the average distance between the distributions of spectral class probabilities.

To analyse the pressure, in addition to the map, we used additional data described in Table 1. Beyond this, for the analysis of the environs, a 10 km radius was calculated from the boundary of each indigenous territory and for the image processing, the following categories of land use were used: agriculture, water, wetland, savannah, forest, fluvial island, cloud, livestock, burning area, exposed rock, shadow and urban. They were all studied from the observation in the field. This value is suggested by the legislation of protected areas that do not have management plans.

As for the analysis of anthropic pressure, it was still necessary to establish which of the analysed variables contributed most to the pressure in the areas surrounding the ITs. Thus, an Index of Anthropic Pressure (IPA) (Equation 01) was calculated, derived from the Index of Anthropic Transformation, developed by Lèmechev (1982) and quoted by Mateo (1991). By this methodology, the average of the sum of the variables multiplied by their respective weights is found.

$$IPA = \Sigma (\text{use} * \text{weight} + \text{pch} * \text{weight} + \text{roads} * \text{weight} + \text{burningspots} * \text{weight} + \text{transmissionlines} * \text{weight}) / 5.$$

Equation 01: Anthropogenic Pressure Index (IPA).

Source: Lémechev (1982), quoted by Mateo (1991).

Since the weight of each variable is given according with the degree of anthropic pressure, varying from 1 to 10, with 10 indicating maximum pressure. Thus, to determine them we considered the analysis of the reports from the Socio-Environmental Institute (ISA) that revealed which of these uses put most pressure on the indigenous territories in the Amazon (Carneiro Filho e Souza, 2009).

The tabulated data were submitted to algebraic analysis of maps. In this sense, the algebraic elements of the maps described by Tomlin consist of maps that assign to each location of a given area of study a quantitative (scalar, ordinal, cardinal or interval) or qualitative (nominal) value (Lamb et al., 2007).

Table 1 - Weight Usage on Indigenous Lands

Classes of Usage	Usage/Coverage	Source	Classes of Usage	Usage/Coverage	Source
Agriculture	10	Map of usage	Burning	9.5	Map of usage
Water	1	Map of usage	Exposed Rock	1.5	Map of usage
Wetland	1	Map of usage	Shadow	1	Map of usage
Savannah	2.5	Map of usage	Urban	10	Map of usage
Forest	1,5	Map of usage	Transmission Lines	10	ANEEL
Fluvial Island	1,5	Map of usage	Outbreaks of fire	10	INPE
Cloud	1	Map of usage	Dams PHC	10	ANEEL
Livestock	10	Map of usage	Roads	10	SEDAM

Source: National Electric Energy Agency - ANEEL, Secretary of State for the Environment - SEDAM.

Results and Discussion

The results revealed that the surrounding areas of all ITs totalled 5,504,717.63 hectares, and of these, 1,438,577.46 were compromised by multiple usages. The predominant vegetation in the environs of indigenous lands covered 3,740,833.75 hectares, which corresponded to 67.95% of

the study area. Livestock occupied 1,178,447.71 and the agricultural 234,654.49 hectares, corresponding to 21.41% and 4.26%, respectively, of the total area analysed (Table 2).

Insofar as livestock farming and agriculture are high-pressure economic activities on ITs, since for their application, as noted, the total removal of vegetation is required. Of course, this practice brings numerous impacts, among which are highlighted the loss of soil and consequent siltation of bodies of water.

Table 2 - Quantitative Given the use of classes in the study area

Classes of usage	Area in hectares	%
Agriculture	234,654.49	4.26
Water	62,973.48	1.14
Wetland	107,290.24	1.95
Savannah	162,548.44	2.95
Forest	3,578,285.31	65.00
Fluvial island	461.58	0.01
Cloud	78,895.39	1.43
Livestock	1,178,447.71	21.41
Burning	20,947.95	0.38
Exposed rock	13,856.44	0.25
Shadow	61,829.29	1.12
Urban	4,527.31	0.08
Total	5,504,717.63	100.00

Source: The authors, 2014.

For the reasons given, keeping in mind that livestock farming was the most recurring usage in the area surrounding the indigenous territories, data from the Brazilian Institute of Geography and Statistics (IBGE) was consulted, and it was found that, in 1970, there were 23,125 cattle in Rondônia. Also, according to the IBGE (2012), in 2006, the number of cattle was 5,064,683, i.e. an increase of 5,041,558 cattle in 36 years. This shows that there has been, according to the data, an average increase of 140,043.23 bovines annually. In 2012, there were already 12,218,437 cattle, of which 9,288,408 were recorded in the municipalities where indigenous lands are located. Thus, compared to the growth seen in the 36

years of consolidation of the occupation in Rondônia, it can be observed that the number of cattle from 2006 to 2012 increased by an average of 1,192,293.33 cattle per year.

Based on IBGE's data, it was possible to draw up the map in Figure 02, whereby it was observed that the municipalities of Porto Velho, in Rondônia, and Juína, in Mato Grosso, have the largest herds of cattle, which directly affects ITs in Aripuanã Park, Karipuna and Karitiana (Figure 2).

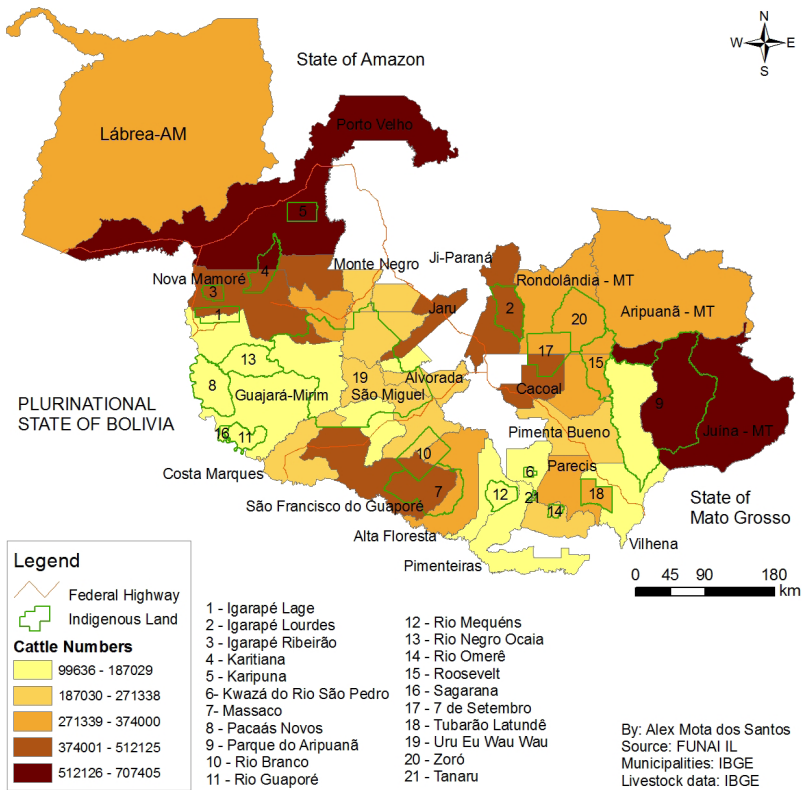


Figure 2 - Cattle numbers by municipality in the areas surrounding the indigenous lands

In this sense, the largest areas occupied by livestock have been identified in the environs of ITs: *Uru Eu Wau Wau*, with an area of 292,766.32 hectares; *Sete de Setembro*, with an area of 110,700.48 hectares and *Igarapé Lourdes*, 91,673.41 hectares. These indigenous lands are

located in municipalities with significant herds of cattle, namely: Nova Mamoée, São Francisco de Guaporé, Jaru, Ji-Paraná, Cacoal, and Monte Negro. Therefore, it was also possible to identify that the municipalities with the largest numbers of cattle are located next to the federal road network (Figure 2). Furthermore, according to data from INPE (2014), of the 37 municipalities that deforested more than 1,000 square kilometres in 2012, 26 have part of their area in some indigenous land. In this context, the municipalities of Porto Velho, Ariquemes and Nova Mamoré were jointly the most prevalent in deforestation in 2012, being responsible for an area totalling 14,499 km² (Figure 3).

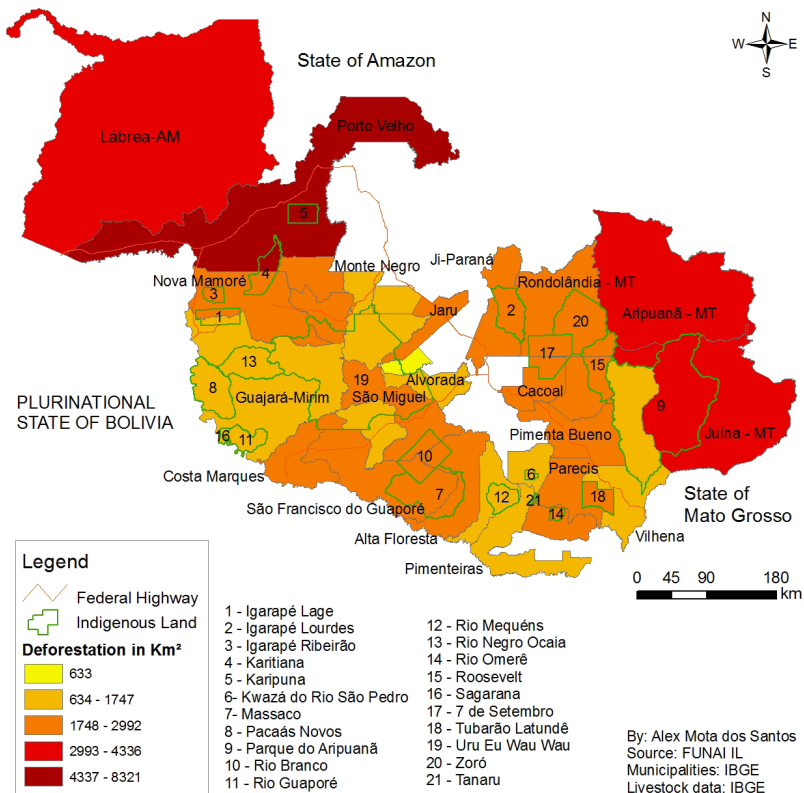


Figure 3 - Deforestation in the municipalities surrounding the area of indigenous lands in Rondônia

The urban area occupied 4,527.31 hectares and was characterized by small urban spots, located in the areas surrounding the indigenous territories of *Igarapé Lage*, *Rio Mequéns*, *Sete de Setembro*, *Roosevelt*, *Tubarão Latundê*, *Uru Eu Wau Wau* and the *Rio Guaporé*.

The *Rio Omerê* indigenous territory (Table 3) is, among the 21 indigenous territories analysed, the one that showed the highest value of anthropic areas, 65.36% of the immediate surrounding area, followed by *Ribeirão* and *Lage* ITs, with 52.56% and 50.34%, respectively. In the area surrounding the *Rio Omerê* IT, 29,938.43 hectares of forested areas were identified, as 40,323.94 hectares have been converted into livestock farming and 25,863.08 hectares into agricultural activities. Thus, amidst the uses of land, livestock farming reached the highest percentage, being approximately 40% of the total of the surroundings. The *Rio Omerê* IT is located in the municipalities of *Corumbiará* and *Chupinguaia*, which jointly account for more than 570,000 cattle.

Table 3 - Quantitative representation of land use classes in the environs of *Rio Omerê* IT.

Rio Omerê IT	Area in Hectares	%
Agriculture	25,863.08	25.54
Water	5,142.42	5.08
Forest	29,938.43	29.56
Livestock	40,323.94	39.82
Total	101,267.87	100.00

Source: The authors, 2014.

The *Rio Omerê* IT together with the indigeneous land of *Rio Mequéns*, *Kwazá do Rio São Pedro* and *Tubarão Latundê* are in the Savannah-Forest transition area. These areas in Rondônia are predominantly on Quartzarenic Neosols, a fact that led to the formation of gullies that increased soil loss in these areas.

The gullies revealed the suspended fences (Figure 4a), resulting from the ravine advancement caused by cattle trailing along the fences. Ravines developed into gullies which reached 8 meters deep and 500 meters long by 10 meters wide (Figure 4b).

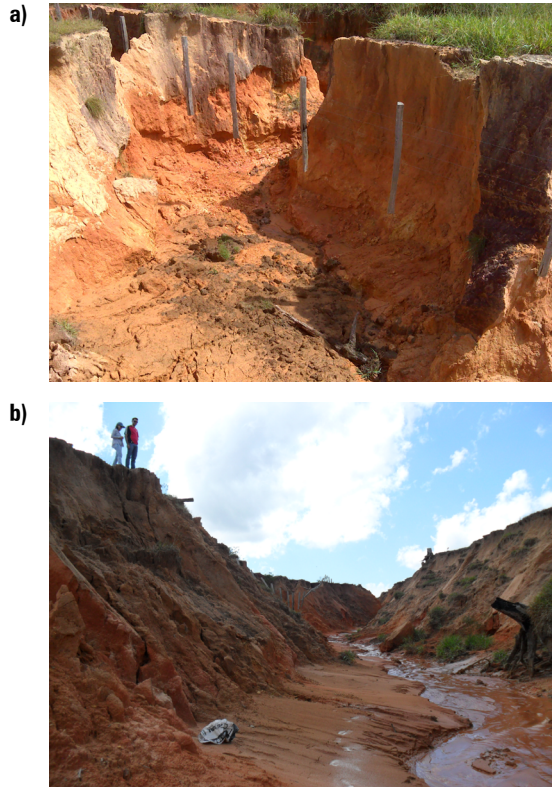


Figure 4 - 4a) Suspended fences in Quartzarenic Neosoil area and 4b) gully in Quartzarenic Neosols in the municipality of *Alto Alegre dos Parecis*. August 2013.

Source: Authors, 2014; Linhares, 2013.

Also, the tracks form gullies, reaching as far as the rivers that drain into the interior of *Tubarão Latundê*, *Rio Omerê*, *Kwazá do Rio São Pedro* and *Rio Mequéns* indigenous lands. In this sense, an analysis of the solid material in suspension in the water was not conducted, but it is acknowledged that increased sediment input can contribute to the clogging of rivers and streams, reducing the depth and negatively impacting on fish populations. Furthermore, once these were areas converted into pasture, and therefore compacted, they lost their fertility through degradation,

preventing the growth of agricultural crops and pastures, a fact which exacerbates the removal of vegetation in other areas.

The areas of transition are located on the raised plateau, with little movement, which facilitates mechanization, also because the savannah is easily removed. Thus, the indigenous lands with more extensive agricultural areas in their surroundings, such as the *Parque do Aripuanã*, the *Rio Omerê* and the *Tubarão Latundê*, located in the south-eastern section of Rondônia, have agricultural predominance, with extensive grain monocultures, particularly soya and corn.

Contrary to the Savannah-Amazon ITs transition zone, the *Rio Negro Ocaia* IT, situated in the southwestern section (Figure 5) was revealed as better preserved, for only 0.31% of the remaining vegetation was removed. Forest occupied 251,852.84 hectares, which corresponded to 97.65% of the surrounding area and the savannahs, characterized as enclaves in the forests, and occupying 0.74%. Preservation occurred in this area because in its environs were identified the *Ouro Preto* Biological Reserve (REBIO) and the *New Pacaás* Extractive Reserve (RESEX), which are protected areas.

However, it seems that the “quiet time” in the environs of *Rio Negro Ocaia* IT will not last long, since the idea, widespread in the 1980s, to build a highway (Santos, 2014), is once again being proposed. In this case, the new highway is earmarked to connect the municipalities of *Pimenteiras of Rondônia* (south) and *Guajará-Mirim* (west).

As shown in Figure 5, it was possible to observe that the indigenous lands are dispersed in the state of Rondônia, isolated, and only two partially contiguous areas were identified: the *Tupi Monde* corridor, in the eastern section, and *Guaporé Mamore Itinez* corridor, in the southwestern section. However, the *Tupi Monde* corridor shows discontinuities owing to the opening of an interstate highway (Rondônia-Mato Grosso) and the subsequent emergence of new occupations along the axis of the road network. The remaining indigenous territories do not have ecological corridors, as they are isolated and their surroundings are taken up by multiple usages.

With further reference to Figure 5, it was possible to witness that the occupation was consolidated in the section where the federal and state road network was pinpointed, especially the BR-364. Effectively, along the federal highways, the pressure of population density becomes greater

when nearing indigenous lands. *Rio Negro Ocaia*, *Pacaás Novos*, *Sagarana* and *Rio Guaporé* ITs are more isolated, far from the road network, thus further away from the cattle farming areas, and therefore under less pressure from the expansion of agribusinesses.

The major IT in the State of Rondônia, the *Uru Eu Wau Wau* exhibited alterations in the north, south and east sections, while maintaining the conservation of forest vegetation only in the western section, which borders the *Rio Negro Ocaia* IT and *Guajará-Mirim* State Park. The area surrounding the *Uru Eu Wau Wau* IT occupied 783,033.10 hectares, 37.39% of which had converted into an area for cultivation of exotic grasses for cattle feed, especially *Brachiaria*.

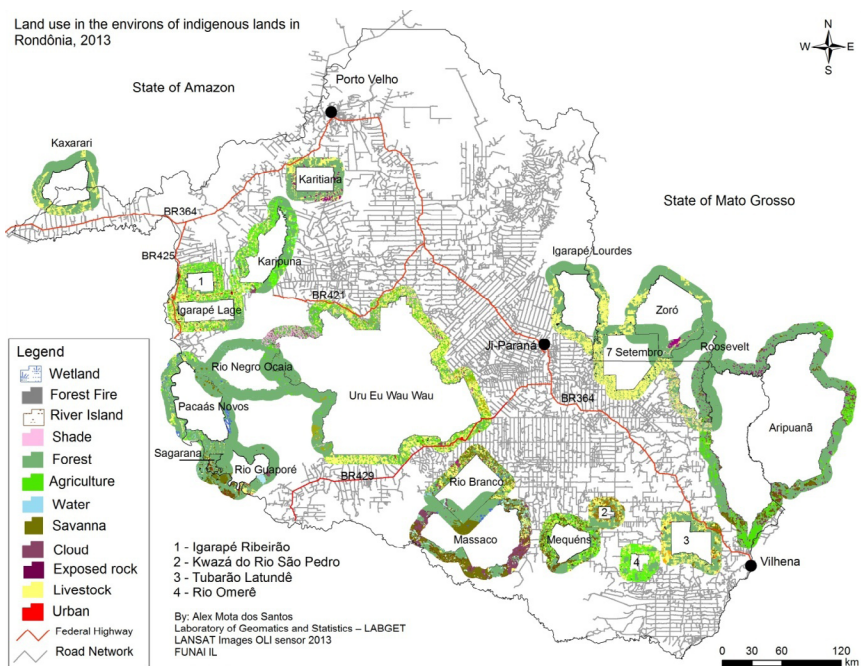


Figure 5 - Occupation in the environs of the indigenous lands of Rondônia

The smaller Rondônia IT is the *Tanaru*, with an area of 8,070 hectares, but it is interdicted (FUNAI, 2014) and it was not a target of anthropic pressure analysis. Another indigenous territory of a lesser area is *Kwazá do Rio São Pedro*, located in the southern section of Rondônia. In

relation to its surrounding area, it is well preserved, with 48.23% covered by forests and 21.42% covered by savannahs, while livestock farming took up 29.76% of the surrounding area. Thus, the agricultural extension is small, with significant areas of cultivation not being expressly identified in the satellite images of medium spatial resolution.

Equally important is to note that the lands located along the axis of federal highways are also exposed to the presence of the main cities of Rondônia, Porto Velho, the capital, and the city of Ji-Paraná, which has the second largest population in the state. This factor has contributed to their exposure.

In employing spatial analysis of the area surrounding the *Rio Omerê* IT, which as observed was that most under pressure among the 21 analysed, it was possible to identify a worrying scenario as it stood in the midst of areas occupied by grazing and agriculture, which border indigenous lands (Figure 6).

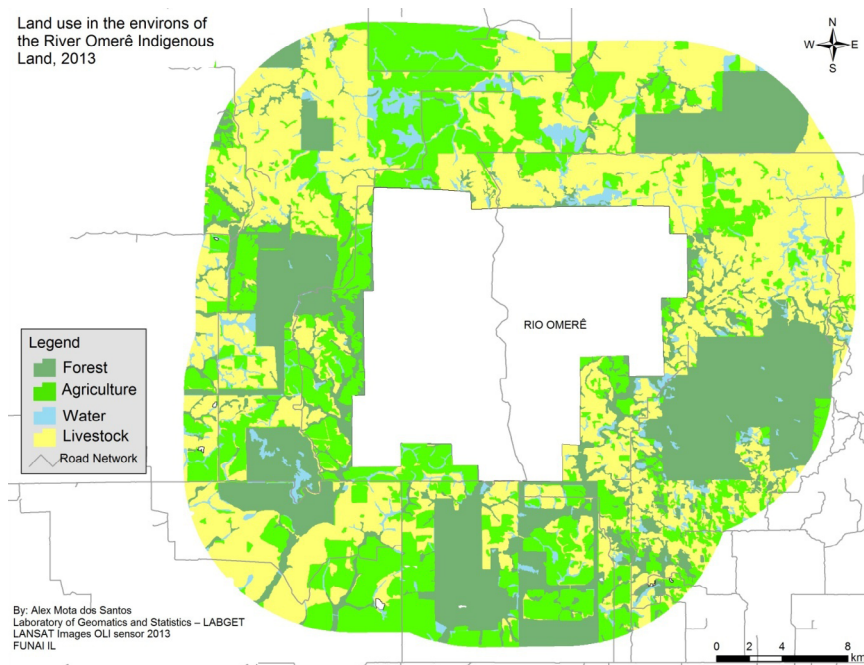


Figure 6 - Occupation in the environs of the *Rio Omerê* IT

Other elements of great socio-environmental impact are: the unpaved municipal road that crosses the *Rio Omerê* IT in a north-south direction, as well as dams for the production of electricity - small hydroelectric power plants -, which is a factor that explains the vast area classified as water in the environs of this IT.

In addition, 182 fragments were found in the remaining vegetation, 164 being recorded as smaller than one hectare, 15 fragments with areas that ranged from one to ten hectares, and only three fragments having areas greater than ten hectares. Therefore, the *Rio Omerê* IT is isolated, although it is located very close to the *Tubarão Latundê* IT.

In this sense, part of the vegetation removal in the *Rio Omerê* IT area was reported by FUNAI (FUNAI, 2011). According to the report, a farmer occupied an area inside *Rio Omerê* IT, claiming not to have received compensation for the improvements to the property. So the farmer was issued with an environmental permit and authorization for forest exploitation by the State Department of the Environment (SEDAM). However, the Public Ministry annulled the licence and granted an injunction suspending the effects of the authorization.

Analysis of Anthropic Pressure

Based on the variables defined for the research of pressure on indigenous lands in Rondônia, it was established that approximately 70% of the total area of the environs are low on the Anthropic Pressure Index (IPA), while 3.54% were high on the IPA, with 0.21%, very high (Table 4).

Table 4 - Quantitative indication of IPA in the environs of indigenous territories in Rondônia

Level	IPA	Area per ha	%
Low	1 – 2.7	3,748,852.55	69.06
Moderate	2.8 – 4.5	1,476,082.30	27.19
High	4.6 - 6.3	192,047.64	3.54
Very High	6.4 – 8.1	11,151.15	0.21
Total	1 a 10	5,428,133.64	100

The results confirmed that those ITs easily accessible through the road network are those with higher IPA. This data revealed that the

road network that exposed indigenous lands to indiscriminate access, contributed to non-indigenous anthropic pressure, since the roads are built by State Government order, which explains much about the protagonists responsible for the pressure on indigenous lands in Rondônia. So, one has to agree with Mello (2003), when he asserts that the state still has a substantial role in encouraging the occupation of Rondônia.

In addition, it was observed that of the ITs analysed, 16 showed high IPA and the *Uru Eu Wau Wau* IT and Sete de Setembro represented areas with very high IPA (Figure 7).

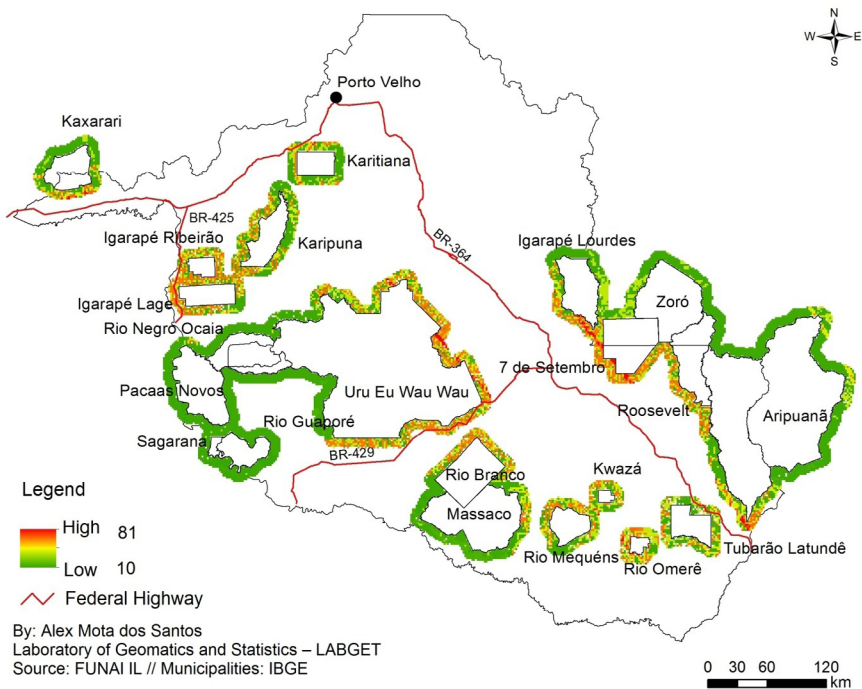


Figure 7 - Anthropics Pressure Index in the environs of indigenous lands in Rondônia

Accordingly, we must agree with Mello (2003) that the National State stands out for its encouragement of occupation in the Amazon. Consequently, the National State, through its banks, also finances countless cattle ranches in the environs of indigenous lands in Rondônia,

leading to a concentration of economic matrix on this activity. Therefore, in order to facilitate credit for cattle farming, energy production and agriculture the state is favouring the conversion of Rondônia landscapes.

Another aspect to be discussed is the small hydroelectric power plants, which have spread rapidly through the rivers of Rondônia, leading various indigenous peoples to complain that such practices contribute to changes in the migratory cycle of fish and turtles (Santos, 2014). These changes were brought to notice by Santos (1995) when the author observed that some very common species of fish fauna in the pre-spawning period did not appear in the post-spawning period in *Samuel* reservoir in Rondônia. According to the same research by Santos (1995), some species have remained, but in a small percentage, while others increased significantly, thus contributing to the environmental imbalance.

Following this discussion, we propose the creation of buffer zones and ecological corridors in the environs of indigenous lands, and that these can be implemented as permanent protection areas on the borders of rivers and legal reserves. In this way, there would be less negative impact affecting indigenous lands, ensuring the physical and cultural survival of indigenous peoples.

Final Considerations

Discussion on the subject of multiple usages in the environs of indigenous lands is urgent and necessary in the context of blatant attacks on the rights of indigenous people in Brazil. What was seen in Rondônia was the predominance of deforestation in the surrounding areas for cultivation of exotic grasses for the rearing of cattle, plus grain farming in the southeast of the state. Moreover, despite the presence of vegetation in the environs of some indigenous reserves, it is fragmented. It was also observed that many territories are cut off by agricultural practices in areas that should be interconnected by corridors.

In this sense, the indigenous lands located next to the more structured road network are under greater pressure, since they are exposed to indiscriminate circulation by societal encompassment. On the contrary, it was found that the indigenous lands located close to units of conservation and remote from the road network are better preserved, favouring ecological corridors. Consequently, the pressures are more significant in indigenous

lands ensconced in the area of intense occupation within the axis of federal highways, especially the BR-364, BR-425 and BR-429.

For all of the above, it is possible to infer that the occupation and the increased surrounding pressure contribute to the exposure of indigenous peoples and their way of life. In addition, this occupation results in natural resources on their lands becoming scarce and thus making access difficult for indigenous communities. Indeed, it is expected that the outcome of this research will broaden discussions on occupation and anthropic pressures on the environs of indigenous lands in Rondônia. Finally, we advocate that the implementation of PNGATI and the protection of the surrounding areas as IT buffer zones throughout the country become a public policy.

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