

Environment impacts and charges during the process of urban

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Abstract— The city of Manaus has his urbanization pushed due to wide scale of migration of populations of the interior for the city in search of improvement in the Industrial Pole and Manaus (PIM), producing occupations messed up to the detriment of the forest and I use the ground altering the nature and intensifying changes in the space reducing to vegetation when the deforestation was owed. Before the exposed one, the work had as objective analysed the environmental impacts and the scenery losses in function of the urbanization. The collected data were through the navigator Google Earth referring to the 1985 years, 1990, 1995, 2000, 2005, 2010 and 2015 comparing the urbanization process to each five years. The year of 1985 suffered small urbane occupations whereas in 1990 the increase was significant in the urbanization when the economical outbreak and civil constructions were owed. From 2000, there were urbane occupations controlled by the government, as well as in the 2005's that had an increase in the vegetation area when laws were owed you implemented for the UC's and the New Code Forest. In 2015, the Top of the World of 2014 produced few occupations, but it kept on producing environmental impacts in the forests around the city.

Keywords— Urbanization; Geoprocessing; Environmental losses.

I. INTRODUCTION

The urban space gains a new visibility with the population growing due to migratory process that is caused by the formation of countless neighbourhood which becomes part of the city's periphery. Because of this accelerated urbanization, the city of Manaus, has been facing with an elevated number of irregular occupancy in the last three decades, the so called "invasions".

Due to Industrial pole of Manaus's (PIM) demands, there have been a migration in large scale of people from the country side to the cities, which in turn has no appropriate pan causing an expressive change in the urban environment [1].

In a fast way, the growth of these migrations, within the passing years, resulted in a messy occupancy to the detriment of the forest, not prioritizing the use of the soil, ceasing to be a government prerogative. According to [2], the urbanization in the country, with the growth of these centers, occurred mainly caused by the losses of the jobs in the rural sectors, the implementation of machines and equipment, decreasing the countryside manpower, resulting in the migration of many families looking for a better life.

[3] quotes that the Brazilian cities, within the passing years, have been exposing lack in infrastructure and they are growing against their administration capacity and local planning.

This process causes many environment changes like nature transformation and increasing the constant changes in the space, among them there are the reduction of the vegetation caused by the deforestation – initial process – in favour of the constructions of public ways, increase of paved areas, waterproofing, air pollution, enhancing the quality of buildings and, with these, changes of the winds, decrease in the absorption of air and water [4].

For [3] before degrading the natural environment, the society, between its relationships and economy, degrades itself, reflecting in the urban area above all else. The vegetation roof removal and its replacement for buildings constructions causes environment degradation, causing the fragmentation of the ecological cycles in the urban area [5].

The vegetation presented in the areas influences positively the comfort of the cities helping in the reduction of temperature, purification of the air, absorption of particles and polluting agents, quality of aquifers and reduction of sound pollution, and contributes enhancing the life quality at cities and the energy efficiency [6].

When the arborisation starts as a crucial alternative to mitigate the impacts caused to the environment, public politics with this objective are required, and they must be implemented continuously so the environment impacts are diminished with success,

minimizing losses of areas, diversity information and futures of their identity, be them cultural, landscape etc.

According to the Federal Constitution of 1988 (art. 30 and art. 182) and the City Statute [7], as part of urban development politics, it is proposed that the city should create, presser and protect the green areas of the city and also the arborisation system. The city must act through specific laws, restricted for each city, in a way to suppress the local interests, without going against federal and state laws [8].

The Resolution number 87/2016 [9], posts about the Urban Arborisation Master Plan, describing that: “the existence of arboreal individuals is fundamental to the maintenance of the quality of people’s life and ecological balance of the environment in the area of the City of Manaus”, as shown at Art. 225 [8], and emphasise the rights for an ecologically balanced environment.

Still mentioning the COMDEMA Resolution, at its art. 2nd, that shows the implementation of the Urban Arborisation Master Plan, the Municipal Secretary of Environment and Sustainability (SEMMAS) is in charge of the issues related to elaboration, analyses, project implementation, management of urban arborisation, as well as make covenants, corporations, partnerships and permissions with public institutions and privates to achieve the objectives of the Plan [9].

And so, the green urban spaces are divided in three kinds of fragments: the forests; gardens and yards; and the public places. These types described allowed a benefit in the social and environment use, like biotic and abiotic factors. The green spaces in the urban centers offer a great social and cultural contribution, aiming to understand the benefits of vegetation, air, soil and water [10; 11].

This study tries to evaluate the urban landscape of the city of Manaus/AM by analysing the data obtained from 1985 to 2015, between intervals of 5 years, starting from the geoprocessing, trying to explain the environmental impacts and the losses of landscape caused by the urbanization.

II. MATERIAL AND METHOD

Type of Study

It is about an exploratory research to define the changes of use of the modified soil during the urban expansion of the City Manaus, using the exploratory and descriptive methods. According to [12], the descriptive analysis tries to describe the characteristics of determined population or phenomena using standardized technics of data collect and/or systematic observation.

The explanatory analysis aims, or familiarizes the researcher with facts and phenomena related to the issues to be studied by investigations and allowances related to the theme [13].

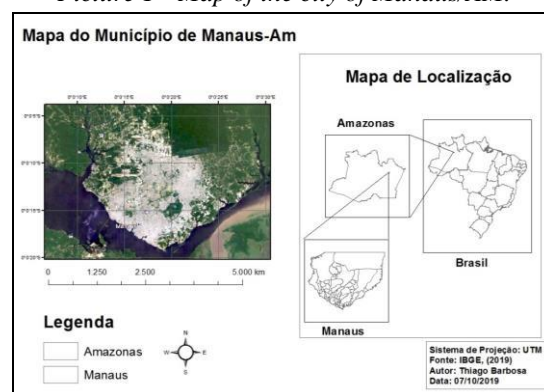
This work was developed with characteristics of quantitative research, for according [14], it seeks objectivity through the reality that can only be understood by using raw data collected using standardized and neuter instruments, and so being able to describe the causes of a phenomena, the relations between variables etc.

Field of study

The field of study comprise the urban perimeter of the city of Manaus, at the coordinates 3°06’26” S and 60°01’34” W (Picture 1), according [15] the surface of the city exhibit 11,458,5 km², which prevail the dense ombrophilous Forest of low soil, also known as primary forest, strands and shoals.

The climate is of 2.100 mm of annual rainfall, with dry seasons during June and October and rainy seasons between November and May, being its standard temperature varying between 24 and 28°C with relative elevated air moisture [16].

Picture 1 - Map of the city of Manaus/AM.



Source: Thiago Fernandes, 2019.

Data Gathering

The information collected from the areas, during the passing time, tries to characterize the vegetation and the losses of landscape caused by urbanization in the city of Manaus, during the last 35 years, where satellite images were acquired available in the site database, referring to the years 1985, 1990, 2000, 2005, 2010 and 2015.

Gathering Instruments

The Geoprocessing System is a computational area able to capture, manage and process geospatial data from objects with attributes having information about its

geographic location related to a system of geographic coordinates [17].

The specific images of vegetation maps and land occupation during the last three decades of the city of Manaus, were obtained through the free internet navigator Google Earth that made possible to compare the areas in process of urbanization through historical images, every five years. The free software ArcGis@ was used through the own app infrared ray to exhibit the areas of urban occupation and other characteristics of the city of Manaus.

III. RESULTS AND DISCUSSION

The use of the soil surface can induce directly and indirectly in characteristics or proprieties of the water, the fluidity of the fauna, loss of habitat and biodiversity, when removed by environment impact, including when under social and economic conditions.

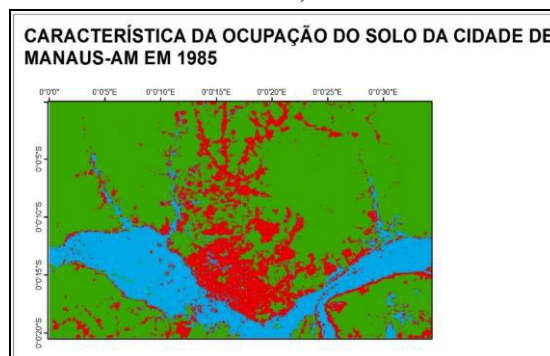
And so the society needs to follow and monitor the areas and their possible impacts, to understand, sensitize and to be responsible for possible losses in short and long terms, the development of these factors in different scales at local, regional and global level [18].

Through the maps generated for the analysis and occupation of the soil in the city of Manaus, from 1985 to 2015, it was to analyse the process of balance of the areas with vegetation (green areas) and increase of the areas of urban occupation (red area) regardless of the type of the use of the soil, with the losses of arborisation, landscape and further information that characterize this region.

In 1985 (picture 2), the urbanized area shows about 167,132 km² (6.82%) with characteristics of small urban areas related to its vegetation that had a bigger domain of 155,703 km² (93.18%). The analysis of this first year indicates a slow process, still a small occupation, even comparing the population of that time.

Even so, in Manaus, the accelerated urbanisation became problematic starting with the creation of the “Zona Franca” of Manaus, by the decree Law #288 of 02/28/1967, generating a process of development to Amazonas state and attracting a great number of people from other states and areas, increasing the population of the city of Manaus and, consequently, urban issues like public health care and social prejudice [19].

Picture 2: Characteristics of the Occupation of the city of Manaus/AM, in 1985.

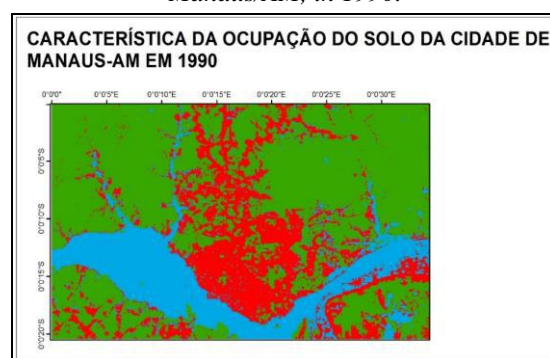


Source: Thiago Fernandes, 2019.

Five years later, in the year 1990, the area of the occupied soil shows an increase of 4% and the substitution of the forest for the occupied area being harmful about 185,537 km² (11.01%).

From the decade of 1990 (picture 3), the process of urbanization, attached to the new technologies, started a new process that caused great environmental impacts generating a massive urban occupation and changes in the use, collaboration with strong processes of environmental degeneration in native areas.

Picture 3: Characteristics of the Occupation of the city of Manaus/AM, in 1990.

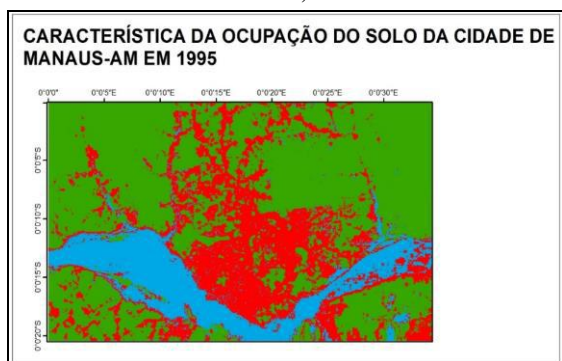


Source: Thiago Fernandes, 2019

There was an economical outbreak caused by the new jobs at the industrial area, just like in the commerce and services related to the industrial expansion, beginning an increase of the population, and increasing of the taxes and the construction market [20].

In 1995 (picture 4), the urban occupation in the soil shows 171,988 km² (7.3%) in relation to the previous five years, where happened a significant decreasing of urbanization, allowing the domain of the vegetation in the period.

Picture 4: Characteristics of the Occupation of the city of Manaus/AM, in 1995.



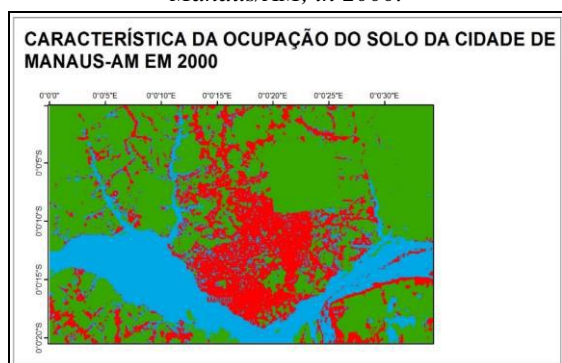
Source: Thiago Fernandes, 2019.

The incessant changes of landscape in the urban area, noted by the people, reveal a solid, concreted and artificial landscape [21], which [3] report that, before the degradation of the natural environment, the society degenerates itself in the social and economic relations, especially in the big cities.

In 2000, the urbanized area became 222,180 km², about 19.75% of increase of urban occupation in relation to the vegetation, being 80.25% at this time, showing significant environmental impacts. The expansions of soil occupation are presented at more distant areas from the center of Manaus (Picture 5).

Between 1990 and 2000, the Brazilian politics of President Henrique Cardoso, offered great expectative to multinational enterprises and landowners, with liberal policies and favours, gaining trust with the real Plan [22].

Picture 5: Characteristics of the Occupation of the city of Manaus/AM, in 2000.



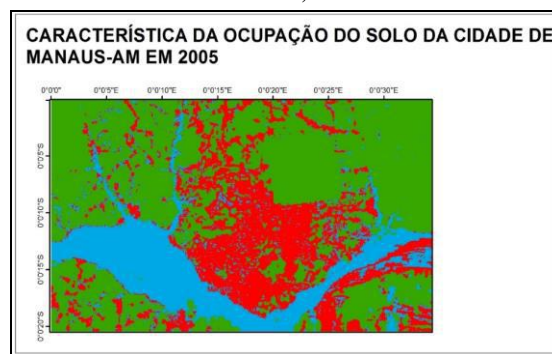
Source: Thiago Fernandes, 2019.

According to [22], social movements to fight for land pressed the government to acquire lands and families settlement, which the FHC government treated as a compensatory policy issue by offering small portions of lands to generate job and development at the countryside and diminishing the rural exodus, ignoring the real

expulsion and migration to the urban area that this kind of movement caused (even today).

The mapping of the city in 2005 (Figure 6) showed a reduction in land use of 182,802 km² (17.72%) compared to the previous five years, in which anthropogenic changes in vegetation characterized few mapping records, demonstrating urbanization approximately equal to the year 2000.

Picture 6: Characteristics of the Occupation of the city of Manaus/AM, in 2015.



Source: Thiago Fernandes, 2019.

The government of Luiz Inácio Lula da Silva, in this period, creates the Land Credit Program allowing the purchase and sale of land in which it was not possible to expropriation for social interest, aimed at individual farmers or groups that had incomes below 15 thousand and less than 30 thousand assets [22], a measure used to contain land use that, according to [23], individual credit only benefited family farmers with more capital and better articulated with the banking network.

In 2010 (Figure 7), the Manaus's city had its land occupation phenomenon of 194,486 km² (6.4%), a similar increase with 1985, leading to the deduction that new vegetation spaces were removed, where the urban occupation, demonstrates that during this period there was a recovery of vegetation in the urban perimeter.

Picture 7: Characteristics of the Occupation of the city of Manaus/AM, in 2010.



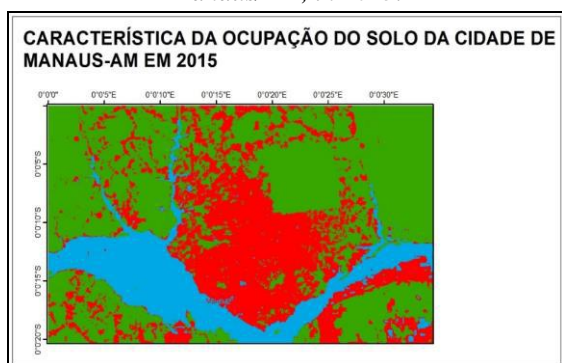
Source: Thiago Fernandes, 2019.

In this period there were already advances of environmental policies in the State of Amazonas with the creation of the State System of Amazonas Conservation Units (SEUC) instituted by the complementary Law 53 of 2007, in which it managed 33 Federal Conservation Units and 41 State Conservation Units being nine of integral protection (3.610.513,13 ha⁻¹) and 32 of sustainable use (15.396.519,49 ha⁻¹) [24].

In 2015, the land use in Manaus (Figure 8), an urbanized area of 171,589 km² (11.77%) in relation to the vegetation area, which continued with significant environmental degradation, even with the reduction of land occupation over the 5 years. previous years.

The new Forest Code was published by Law 12.651/2012 by President Dilma Rousseff, in which were maintained rules and limits for APP's and Legal Reserve, with main novelty the Rural Environmental Registry (CAR) the mandatory national registration of rural properties allowing the government control and manage land use [25].

Picture 8: Characteristics of the Occupation of the city of Manaus/AM, in 2015.



Source: Thiago Fernandes, 2019.

However, it is known that after choosing Manaus to host the Football World Cup, by 2014, according to [26], the World Cup brought to Manaus serious problems related to the removal and occupation of people to make available places for the big event, as well as brought significant impacts on the surrounding forest due to the easing of environmental laws and minimizing the controls of the environmental impacts of the works. disregarding the laws of the country and the environment.

Given the results we can get a better understanding of the period of land occupation in the city of Manaus in the last 30 years through its loss of native vegetation due to the demographic increase of the city which caused landscape and cultural losses.

IV. CONCLUSIONS

In 1985 small occupied urban areas did not significantly measure vegetation, even with the migratory exodus due to the establishment of the Manaus Free Zone. In 1990, the city's land had an 11.01% increase in occupation in five years due to the economic boom, generating new jobs in the city, such as consumption in commerce. In 1995 and 2000, the occupation of urban land in Manaus decreased due to the Brazilian government's FHC's determination of land control and distribution policies to popular movements, as well as the interest of large rural investors.

In the years 2005 and 2010 the city of Manaus slowed the progress on new areas, but the degradation on vegetation continued even with the Lula government managing land purchase and sale for landowners, as well as complementary UC Laws and the New Forest Code. which legally limited land use; In 2015, the degradation of green areas remained high, even with the reduction of urban occupations, but due to major works in the city due to the 2014 World Cup, there was no control by the government over environmental impacts in this World Cup period.

The present work made it possible to understand land degradation and occupation in the city of Manaus over the last 30 years, which intends new scientific arguments about the Amazonian environment, indicating that there is a lot of information about landscape loss, culture, social characteristics, mainly given by disorderly occupation, advancement of new areas (most of them, invasions), declining GDP and ZFM instability.

REFERENCES

- [1] SHARMS, J. C. A.; GIACOMELI, D. C.; SUCOMINE, N. M. **Emprego da arborização na melhoria do conforto térmico nos espaços livres públicos**. REVSBAU, Piracicaba – SP, v.4, n.4, p.1-16, 2009.
- [2] SCHIAVO, E.C. et al. **Urbanização e crescimento populacional da cidade de Sabáudia-PR**. Os desafios da escola pública paranaense na perspectiva do professor PDE, 2016.
- [3] MONTEIRO, C. A. F.; MENDONÇA, F. **Clima Urbano**. Ed. Contexto, São Paulo, 2009.
- [4] FEITOSA, S.M.R.; GOMES, J.M.A.; NETO.J.M.M.; ANDRADE.C.S.P. **CONSEQUENCIAS DA URBANIZAÇÃO NA VEGETAÇÃO E NA TEMPERATURA DA SUPERFICIE DE TERESINA-PIAU**. REVSBAU, Piracicaba – SP, v.6, n.2, p.58-75, 2011.
- [5] DOBBERT, L. Y.; ZANLORENZI, H. C. P. **ARBORIZAÇÃO URBANA E CONFORTO TÉRMICO: UM ESTUDO PARA A CIDADE DE CAMPINAS/SP/BRASIL**. Revista LABVERDE, n. 09, artigo 04, dez. 2014.

- [6] VELASCO, G.D. N. **Potencial da arborização viária na redução do consumo de energia elétrica: definição de três áreas na cidade de São Paulo – SP, aplicação de questionários, levantamento de fatores ambientais e estimativa de Graus-hora de Calor.** Tese (Doutorado em Agronomia), São Paulo: Universidade de São Paulo, 2007.
- [7] BRASIL. Lei Nº 10.257, de 10 de Julho de 2001. **Estatuto da Cidade.** Brasília: Senado Federal, 2001. Disponível em: <http://www.planalto.gov.br/ccivil_03/leis/LEIS_2001/L10257.htm> Acesso em: 26 de Outubro de 2019.
- [8] BRASIL. Artº 30, Artº 182 e Artº 225. De 5 de Outubro de 1988. **Constituição da Republica Federativa do Brasil de 1988.** Brasília: Senado Federal, 1988. Disponível em: http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm Acesso em: 26 de Outubro de 2019.
- [9] MANAUS. Resolução Nº 87/2016, de 21 dez. 2016. **Conselho Municipal de Desenvolvimento e Meio Ambiente (COMDEMA).** Manaus: COMDEMA MANAUS, 2016. Disponível em: <http://semmas.manaus.am.gov.br/wpcontent/uploads/2011/08/Cartilha-Plano-Diretor-de-Arboriza%C3%A7%C3%A3o-urbana.pdf> Acesso em: 26 de Outubro de 2019.
- [10] BONAMETTI, J. H. **Arborização Urbana. Terra e Cultura.** ANO XIX, Nº 36, 2007.
- [11] STEINER, C. **Desafios da participação comunitária na conservação e expansão dos espaços verdes. Um exemplo da cidade de Manaus – AM.** In: CONGRESSO BRASILEIRO DE ARBORIZAÇÃO URBANA, 2008, Manaus-AM.
- [12] GIL, A. C. **Métodos e técnicas de pesquisa social.** 6ª ed. São Paulo: Atlas, 2008.
- [13] FONTELLES, M. J. et al. **Metodologia de Pesquisa Científica: diretrizes para a elaboração de um protocolo de pesquisa.** Núcleo de Bioestatística Aplicado à pesquisa da Universidade da Amazônia – UNAMA, 2009.
- [14] FONSECA, J. J. S. da. **Metodologia da Pesquisa Científica.** Centro de Educação da Universidade Estadual do Ceará - UECE, 2002.
- [15] MARQUES, J. P. C; PINHEIRO, E. DA S. **O desflorestamento na metrópole da Amazônia Central: Manaus/AM.** In: Anais XV Simpósio Brasileiro de Sensoriamento Remoto - SBSR, Curitiba/PR, ano 2011.
- [16] COSTA, J. A. L. da. **AVALIAÇÃO DE DADOS DE RADAR DO SENSOR SAR-R99B NO MAPEAMENTO DO USO E COBERTURA DA TERRA NA AMAZÔNIA CENTRAL, MUNICIPIO DE MANAUS, AM.** 2011. 116 f. Dissertação (Mestrado em Ciências Florestais e Ambientais) – Faculdade de Ciências Agrárias, Universidade Federal do Amazonas, Manaus. 2011.
- [17] COSTA, M. S. B. DA; PINTO, V. A. B.; SOARES, C. B. S. DA S. **Análise de desmatamentos na zona leste, norte e oeste da área urbana de Manaus/AM.** IV Simpósio Brasileiro de Ciências Geodésicas e Tecnologias de Geoinformação, Recife, p. 01-09, mai. 2012.
- [18] ROCHA, N. C. V. **Dinâmica do uso e cobertura do solo entre os anos de 2004 e 2014 para o município de Capitão Poço, Pará.** Enciclopédia Biosfera, Centro Científico Conhecer, Goiânia, v. 14, n. 26, p. 281, dez. 2017.
- [19] ASSAD. T. M. **A problemática das “invasões” na cidade de Manaus: perspectiva de legalização fundiária à luz do estatuto da cidade.** In: Anais XV Congresso Nacional do CONPED, Manaus/AM, 2006.
- [20] BECKER, B. K. **Surtos de Crescimento de Manaus.** Espaço Aberto, PPGG – Universidade Federal do Rio de Janeiro, v. 03, n. 01, p. 19-44, 2013.
- [21] PINHEIRO, C. R.; SOUZA, D. D. de. **A importância da arborização nas cidades e sua influência no microclima.** Revista Gestão & Sustentabilidade Ambiental, v. 06, n. 01, p. 67-82, abr./set. 2017.
- [22] VECINA, C. C. **O II Plano Nacional de Reforma Agrária do governo Lula: uma análise além do aparente.** In: Anais XXI Congresso Nacional de Geografia Agrária, Universidade Federal de Uberlândia – MG, v. 15, 2012.
- [23] SABOURIN, E. **Que política pública para a agricultura familiar no segundo governo Lula?.** Sociedade e Estado, V. 22, n. 3, p. 715-751, 2007.
- [24] LIRA, T. de M. et al. **Participação social e política ambiental no Estado do Amazonas.** In: Anais VII Jornada Internacional em Políticas Públicas, Universidade Federal do Maranhão, ago. 2013.
- [25] PRAES, E. O. **Código Florestal Brasileiro: Evolução histórica e discussões atuais sobre o Novo Código Florestal.** In: Anais VI Colóquio Internacional Educação e Contemporaneidade, São Cristóvão, Brasil, 2012.
- [26] SANTOS JÚNIOR, O. A. dos; GAFFNEY, C.; RIBEIRO, L. C. de Q. **Os impactos da Copa do Mundo 2014 e das Olimpíadas 2016.** E-Papers, Rio de Janeiro, 2015.