Estrabão
Vol(3):75 - 90

DOI: 10.53455/re.v3i.26

Hot Spots, burnings and respiratory problems in the city of Campo Grande-MS in the period 2014-2020

Bianca Garcia Oliveira[1] and Vicentina Socorro da Anunciação[1]

Abstract

The use of fire to carry out burnings is a cultural and frequent practice, causing harmful consequences both to the environment and to human health, triggering influences on climate variability, loss of biodiversity, driving the fauna away, and bringing on respiratory problems, among others. The production of urban space in the city of Campo Grande-MS and its territorial expansion have made it a place of major transformations over time that have generated environmental changes with repercussions on the lives of the population, such as burnings. In this sense, this study brings reflection on the data on hot spots, fires, climate and respiratory system diseases in the city of Campo Grande-MS, from the comparison between the related variables. Data on diseases of the respiratory system were obtained from the Hospital Information System of the National Health System of Brazil (DATASUS/SUS) on notified and confirmed cases; Precipitation data were concatenated from the INMET Database (National Institute of Meteorology) available at the CEMTEC Database (Weather and Climate Monitoring Center of Mato Grosso do Sul), information related to hot spots was collected from BDQueimadas (Database of fires) at INPE (National Institute for Space Research). The results show that many action strategies have been carried out to revert the occurrences, but in a rather palliative perspective; thus, specific problems continue to occur, requiring more incisive measures.

Keywords

Hot spots, climatic variables, diseases, urbanization

[1] UFMS, Aquidauana, Mato Grosso do Sul, Brazil
Email: vanunciacaoufms@gmail.com (Vicentina Socorro da Anunciação)

Corresponding author:
Bianca Garcia Oliveira, UFMS, Aquidauana, Mato Grosso do Sul, Brazil
Email: vanunciacaoufms@gmail.com@0000000185715109.

Introduction

Burning is a recurrent practice that impacts both the environment and human health, and the increase in the incidence of this phenomenon potentiates the potential for worsening adversities. Thus, research on fires is an important tool for analysis, reflection and discussion on the issue. In this sense, the geographic science becomes essential to the discussion of the problem, since it involves space and the interactions established.

In Brazil, burning is associated with anthropic action, being characterized as a recurrent cultural practice, used for the purpose of renewal of pastures and land clearing, and it is also associated with deforestation (HORN, M. 2017p.15). Thus, it is important to highlight the concepts of hot spots, burning and wildfires. According to Gontijo, G. et al. (2011, p.7966) hot spots are "geographical coordinates captured by spatial sensors on the ground surface, when detecting temperature above 47 ºC and minimum area of 900 m^2"; and according to Lopes, L. et al. (2018, p.118) "the burnings have anthropic origin and wildfires can occur naturally or anthropically".

In this sense, according to information from BDQueimadas (Burn Database) of INPE (National Institute for Space Research), in the year 2019, 197,632 hot spots were detected in Brazil compared to 2020, which totaled 222,797 hot spots detected from all satellites (INPE, 2019-2020a).

In the state of Mato Grosso do Sul, there were 11,653 hot spots in 2019 compared to 2020, which totaled the quantitative of 12,080 hot spots (INPE, 2019-2020b). The municipality of Campo Grande presented 913 hot spots in 2019 and 1,547 in 2020, with the information coming from all satellites (INPE, 2019-2020c). It is noteworthy that from these indices, the quantitative 420 hot spots, according to table 1, occurred in the urban area, where we observe a significant increase in the incidence of hot spots and consequent negative impact on the environment and health.

According to Pinto Junior, S.; Silva, C. (2012, p. 2), the burnings in Mato Grosso do Sul are of anthropic origin in most cases, being linked to "agricultural and livestock expansion" and "climatic factors, added to the geographical ones, i.e., the characteristics of each region, the atmospheric circulation systems, the distribution of rainfall, the dry seasons" characterize the distribution of the phenomenon. In this sense, it is noteworthy that the increased incidence of fires arising from anthropic action mainly in regions and climatic conditions favorable to the spread of fire potentiates the increase of environmental impacts.

According to Morello, T. et al. (2020, p.1), the burnings and forest fires are the main causes associated with air pollution and increase in the number of cases of respiratory problems (...), especially during the dry season. However, according to Morello, T. et al. (2020,p.1) in the year 2020 two factors contributed to the worsening of the situation: deforestation and COVID-19. Thus, we can note that the burnings associated with other factors can contribute to the worsening of respiratory problems.

Thus, fires represent a risk to human health because the emission of particulate material can worsen respiratory problems such as asthma, rhinitis and sinusitis, among others. Referring to the context of the city of Campo Grande, it is possible to infer that fires influence the quality of life of the population and the environment, since the smoke emitted by burning emits particulate matter into the atmosphere, thus influencing the air quality and aggravating respiratory diseases.

In this sense, Geography, as a science that studies space and its interactions with space, becomes essential in research on fires. Hence, inherent to geography of health, it establishes the relationship between the spatial distribution of diseases with these other aspects, and associated with geotechnologies, it can contribute to the analysis and research on environmental issues, mainly related to burning, deforestation and the emergence of diseases. On this account, through the tools, satellite images, software, and remote sensing, it is possible to monitor spatial phenomena, as well as visualize and analyze them through digital maps, in addition to proposing intervention actions in order to stop the occurrence.

This research intends to analyze the relationship between fires and respiratory system diseases in the city of Campo Grande-MS, based on a comparison between hospitalizations, data on hot spots and climatic variables. We start from the following guiding question: Do urban fires contribute to the increase in the incidence corresponding to respiratory diseases in Campo Grande-MS? Thus, we reflect on the occurrences of heat waves and their effects on the use of infrastructure and equipment of health services, considering the importance of research in the correlation of possible processes of change in human health.

Methodology

The research area corresponds to the city of Campo Grande-MS (figure 1), which, according to Planurb (Municipal Agency of Environment and Urban Planning), is divided into seven urban regions: Anhanduizinho, Bandeira, Centro, Lagoa, Imbirussu, Prosa and Segredo (PLANURB, 2020 p.100).

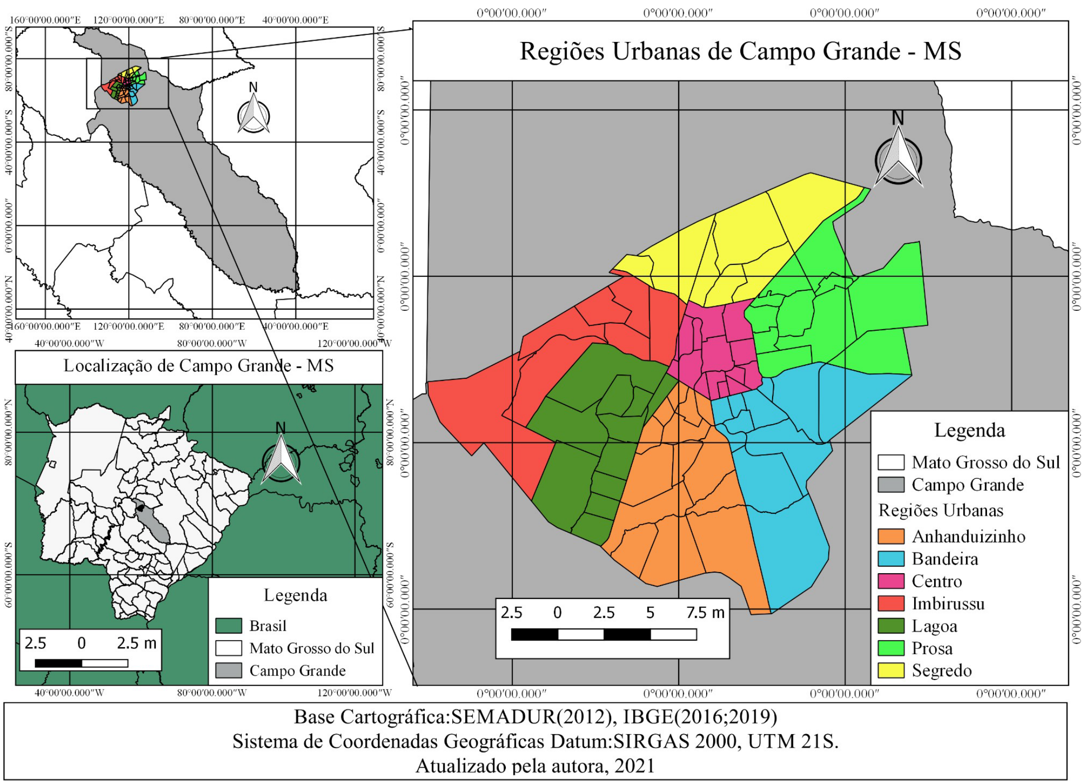

Figure 1. Location of the city of Campo Grande-MS

For the development of this research, a bibliographic review was conducted regarding the geography of health, urbanization, climate and fires, as well as a survey of reported cases regarding respiratory diseases in Datasus, in the period 2014-2020. In this sense, we set out a relationship between cases of respiratory diseases (materialized in the urban space), occurrence of hot spots and climate variables.

Subsequently, the heat fires of all satellites in the period 2014-2020 were downloaded from BDQueimadas/INPE; the information was spatialized in the Qgis software for the configuration of the coordinate system of the fires for Datum SIRGAS 2000, UTM 21S; and the spatial clipping of the fires for the urban area was made through the overlay of the shapefile of the city of Campo Grande, as well as observation of the places with higher incidence. From there, visits were made to the most vulnerable areas, mapping and checking health and environmental conditions. All information was systematized in Word and Excel computer programs with textual formatting, preparation of tables and figures edition.

The cast information was confronted with the cases of disease, seeking to emphasize the influence caused by anthropic action, from the urbanization process in conjunction with the climatic element, precipitation, heat fires and cases of diseases that affect the respiratory system.

Theoretical Basis

The use of fire for burning is an old and cultural practice that, due to its low cost and fast action, is used repeatedly, both for the renewal of pastures and for clearing land with tall vegetation. However, this practice has a direct impact on the environment and on the health of living beings, mainly through the emission of pollutant gases and the aggravation of respiratory problems.

Burnings are a constant problem in Brazil, given the number of hot spots and burned areas annually, as well as the scientific research on this issue. According to data from Inpe (2019-2020a), in the period from July to November 2019, a total of 164,761 hot spots were detected compared to the other months that totaled 32,871 hot spots; in the same period in 2020, the total number of detected hot spots was 190,758, compared to the other months that together totaled 32,039 hot spots.

Thus, it is possible to observe that the most critical months in relation to the incidence of fires were from July to November, with increased incidence in 2020. In the state of Mato Grosso do Sul, the years 2019 and 2020 totaled respectively 11,653 and 12,080 heat spots, compared to the year 2018, that totaled 2380 hot spots (INPE, 2019-2020b).

According to Fernandes, T.; Hacon, S.; Novaes, J. (2021,p.145), in the period between 2010-2018, many scientific researches were conducted on the fires and the effects of particulate matter emissions in the atmosphere that cause climate change, air pollution and negative impact on human health due to respiratory problems.

In view of this, Ribeiro, H.; Pesqueiro, C. (2010, p.263), Silva, A. et al. (2013, p.346), Araújo, F.; Miziara, F. (2014, p.113), Gonçalves, K.; Castro, H.; Hacon, S. (2014, p.1524) point out the following impacts of fires: air pollution resulting from the emission of particulate matter into the atmosphere and the consequent appearance of respiratory problems, in addition to effects on human health, as well as impact on the ecosystem due to the association between deforestation and burning.

Among the main causes of burning is the anthropic action and the increased incidence of hot spots detected by satellite that occur especially in the dry season, given that the climatic characteristics favor the spread of fire (LEÃO, R.; FERREIRA, G.; STRAUCH, J. 2020 p. 180).

According to data from Inpe (2019-2020 c), the municipality of Campo Grande-MS totaled 2,460 hot spots between 2019-2020, being 913 in 2019 and 1,547 in 2020.

Given this context, it is worth emphasizing the importance of geographic science for the analysis of the facts. As a science that studies society and interactions with the environment, especially in the area of health geography, it enables the study of the spatial distribution of diseases related to environmental, social, cultural, economic and political factors. The association of cartography and geotechnologies potentiates the analysis of geographic research, as it makes use of tools such as: maps, satellite images, software like Qgis, among others, which are capable of helping the investigation of different spatial phenomena. In this sense, we highlight the use of geotechnologies in the detection and probing of the spatial distribution of fires and hot spots in this study.

Results and Discussion

Burning is a practice that directly impacts the environment and human health, since it emits particulate matter into the atmosphere, resulting in air pollution and worsening respiratory diseases. Moreover, anthropic action has contributed to the increase in occurrences of fires, especially in dry periods favorable to fire propagation, demonstrating that the incidence of fires is associated with climatic conditions, with negative impact on human health and the environment.

Thus, Geography, particularly the geography of health, makes it possible to establish this relationship between the studied phenomenon and the environment in which it is inserted. In this sense, the use of geotechnologies to obtain satellite images through remote sensing and the analysis of the spatial distribution of hot spots in the city of Campo Grande allowed the analysis of the locations of incidence and the recurrence of hot spots in conjunction with climatic, social and cultural aspects, among others.

Table 1. Hot spots and precipitation in Campo Grande

Year	Number of hot spots in urban areas	Number of hot spots in rural areas	Total hot spots in the city	Annual precipitation (mm)
2014	63 hot spots	295 hot spots	358 hot spots	1,523.8 mm
2015	81 hot spots	316 hot spots	397 hot spots	1,522 mm
2016	104 hot spots	336 hot spots	440 hot spots	1,590.4 mm
2017	139 hot spots	518 hot spots	657 hot spots	1,694.2 mm
2018	65 hot spots	218 hot spots	283 hot spots	1,145.8 mm
2019	205 hot spots	708 hot spots	913 hot spots	1,201.4 mm
2020	215 hot spots	1,332 hot spots	1.547 hot spots	1,079 mm
Total	872 hot spots	3,723 hot spots	4.595 hot spots	9,756.60 mm

Source: Updated by the author, based on information from INPE, 2014-2020; CEMTEC/SEMAGRO, 2014; 2015; 2016; 2017; 2018; 2019; 2020.

According to Table, 1 it is possible to observe that in the period (2014-2020), the years 2020, 2019 and 2017 represent the highest incidence of hot spots in the municipality, totaling 3,117 hot spots, associated with the annual precipitation; we note that the year of highest incidence of hot spots showed a reduction in precipitation rates, totaling 1,079 mm. Thus, the relationship between the climatic variable, precipitation and hot spots is notable, as when there is more precipitation, there are fewer hot spots. With respect to the urban area of the municipality, the period with the highest number of hot spots occurred between 2017, 2019 and 2020, with a total of 139 hot spots in 2017, 205 hot spots in 2019 and 215 hot spots in 2020; we note that precipitation in this period totaled 3,974.6 mm. However, it is necessary to evaluate the monthly quantitative, as shown in Table 2.

Rainfall (mm) in Campo Grande

Table 2.

	MONTHS												
YEARS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2014	160.40	110.80	155.00	49.40	183.00	54.20	119.20	17.20	65.80	19.00	225.60	364.20	1.523,8
2015	254.80	161.00	72.60	100.00	135.60	40.40	87.20	8.60	225.40	95.60	150.00	190.80	1.522
2016	382.60	185.20	190.00	70.8	206.80	48.80	5.40	65.60	37.00	91.40	116.80	190.00	1.590,4
2017	220.00	87.00	226.60	157.00	104.60	45.80	0.20	38.20	45.00	228.60	315.80	225.40	1.694,2
2018	138.40	199.80	97.40	89.6	37.40	11.00	0.00	112.20	89.40	167.40	148.20	55.00	1.145,8
2019	55.60	271.80	145.60	104.40	76.40	20.60	46.40	2.00	16.00	30.80	149.60	282.20	1.201
2020	164.80	227.20	80.20	80.20	90.20	41.20	4.00	35.60	8.40	150.40	100.40	96.40	1.079
Total	1376,6	1242,8	967,4	651,4	834	262	262,4	279,4	487	783,2	1206,4	1404	9.756,60

Source: CEMTEC/SEMAGRO 20114-2020

Table 2 shows that the months with the most rainfall in 2014 were November (225.60mm), December (364.20mm) and May (183.00mm), totaling together 772.8 mm of rain. In the year 2015, the months of January (254.80mm), September (225.40mm) and December (190.80mm) totaled 671 mm of rain. In the year 2016, the months with the most rainfall were January (382.60mm), May (206.80mm) and March (190.00), totaling 779.4 mm of rain. In 2017, the months were respectively November (315.80mm), October (228.60mm) and December (225.40mm), totaling 769.8 mm of rain. In the year 2018, the months were February (199.80mm), October (167.40mm) and November (148.20mm), totaling 515.4 mm of rain. In 2019, the months were December (282.20mm), February (271.80mm) and November (149.60mm), totaling 703.6 mm of rain. And for 2020, the months with the most rainfall were February (227.20mm), January (164.80mm) and October (150.40mm), totaling 542.4 mm of rain. We can note that the months with the highest rainfall index in the analyzed period correspond to the summer months of December (1404 mm), January (1376.6 mm) and February (1242.8 mm), totaling 4,023.4 mm of rain. The occurrences in the quantitative volume variations over the years are noteworthy, as they show an indirect relationship between the quantity of fires and rainfall. Thus, it is possible to observe in figures 1-7 the spatial distribution of hot spots in the urban area of Campo Grande.

In figures 1-4, it is possible to observe the spatial distribution of hot spots in Campo Grande, with the urban regions of Anhanduizinho, Bandeira, Imbirussu and Segredo presenting the highest incidence of hot spots, totaling respectively 69, 61, 80 and 76 hot spots in the period 2014-2017; comparing with the precipitation data, we can note that the period 2014-2017 was rainy, totaling 6,325.6mm, so it is not possible to state that there is a direct relationship between precipitation and hot spots, however, it is possible to state that the episodes of hot spots may be associated with anthropic action.

As shown in Figures 5-7, there is a higher incidence of spots compared to previous years from 2014-2017, and in the years 2019-2020, a total of 485 spots were detected. An increase in hot spots from 2019 compared to previous years is noted, with 2019 totaling 205 hot spots, compared to 2018, which totaled

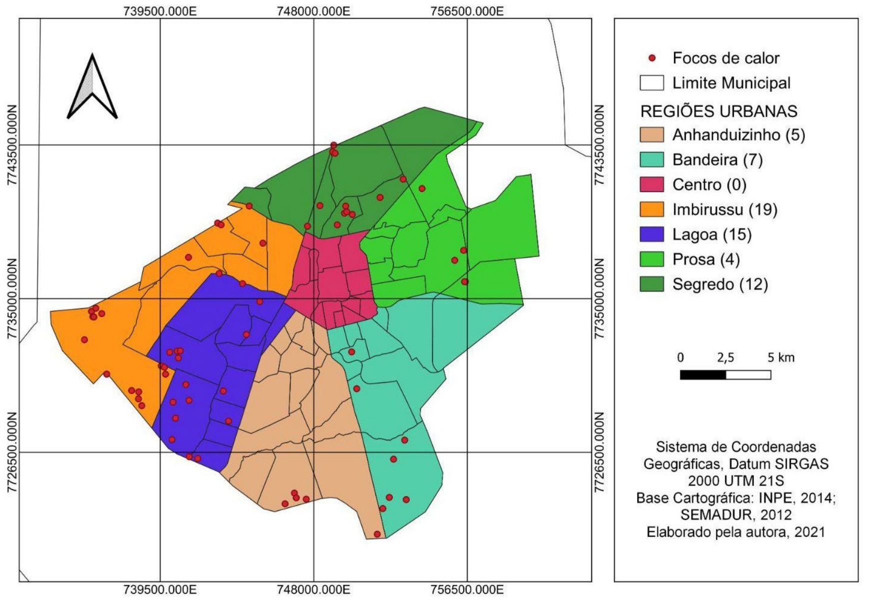

Figure 2. Heat spots by urban region in 2014

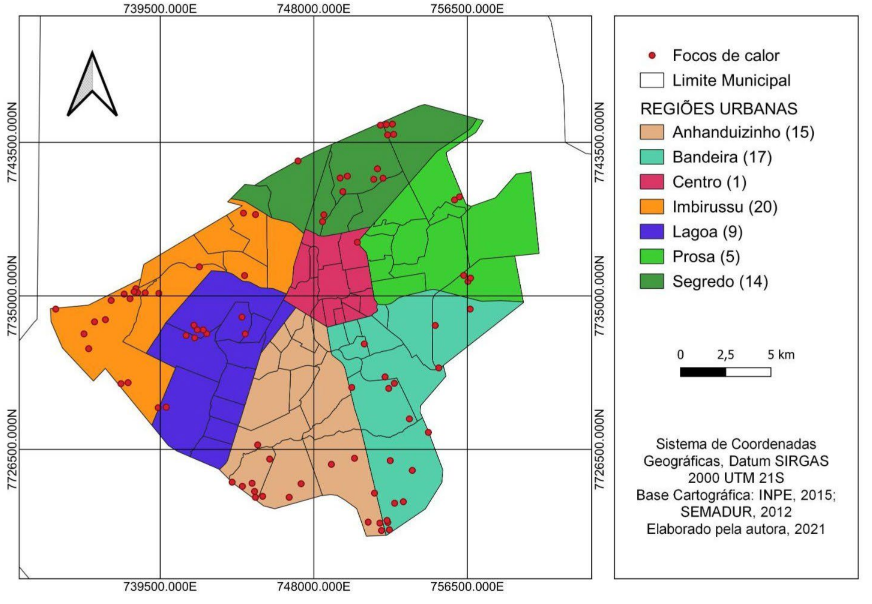

Figure 3. Heat spots by urban region in 2015

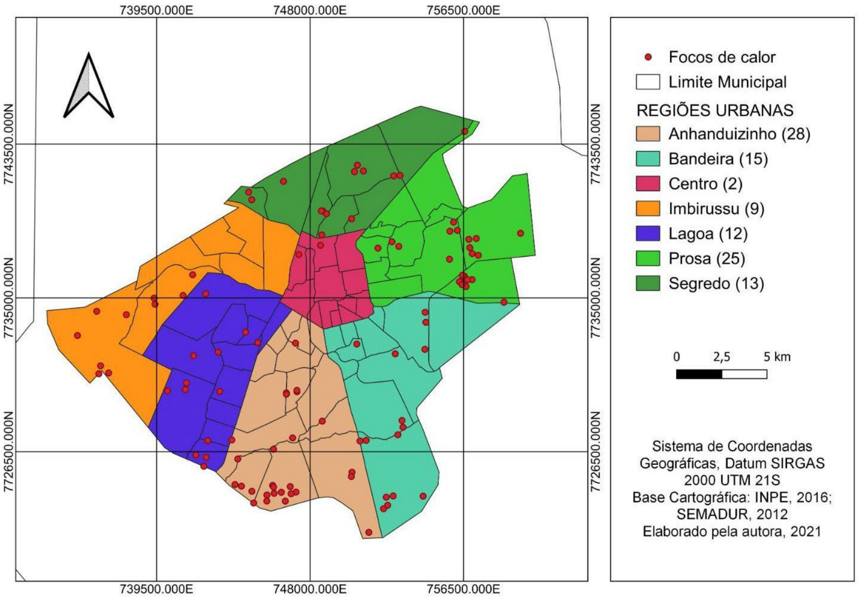

Figure 4. Heat spots by urban region in 2016

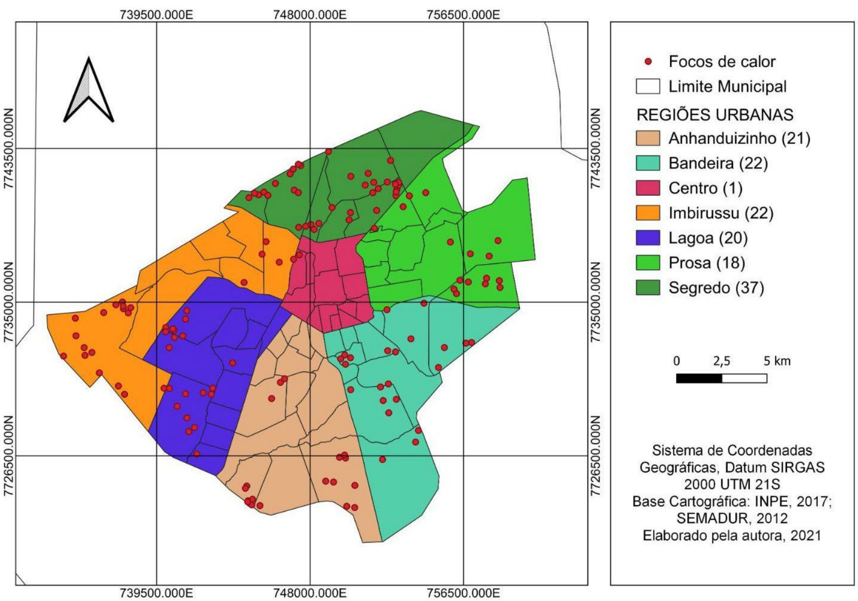

Figure 5. Heat spots by urban region in 2017

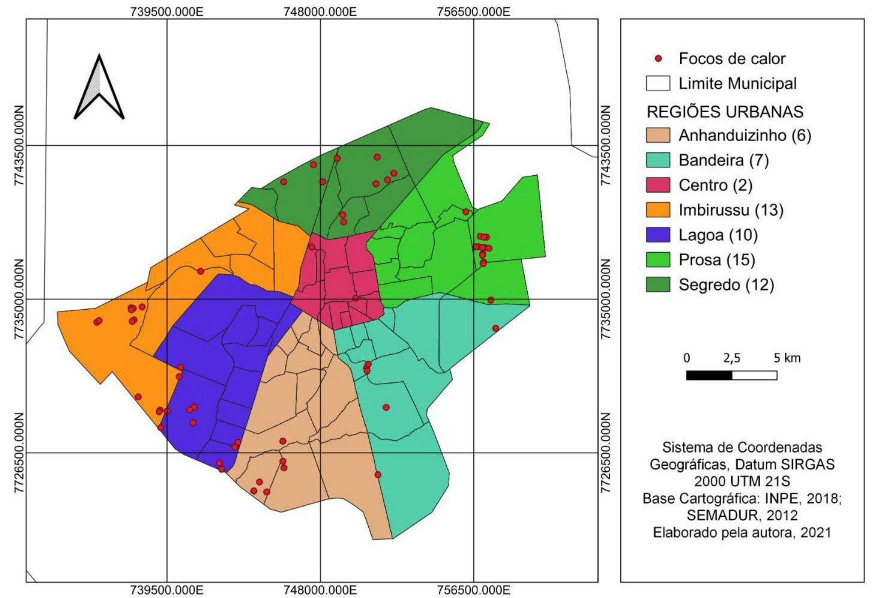

Figure 6. Heat spots by urban region in 2018

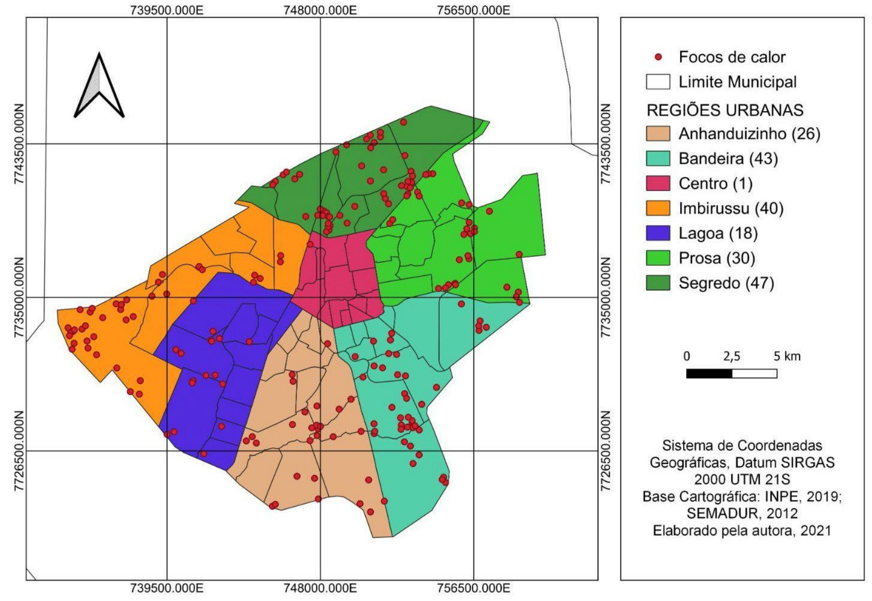

Figure 7. Heat spots by urban region in 2019

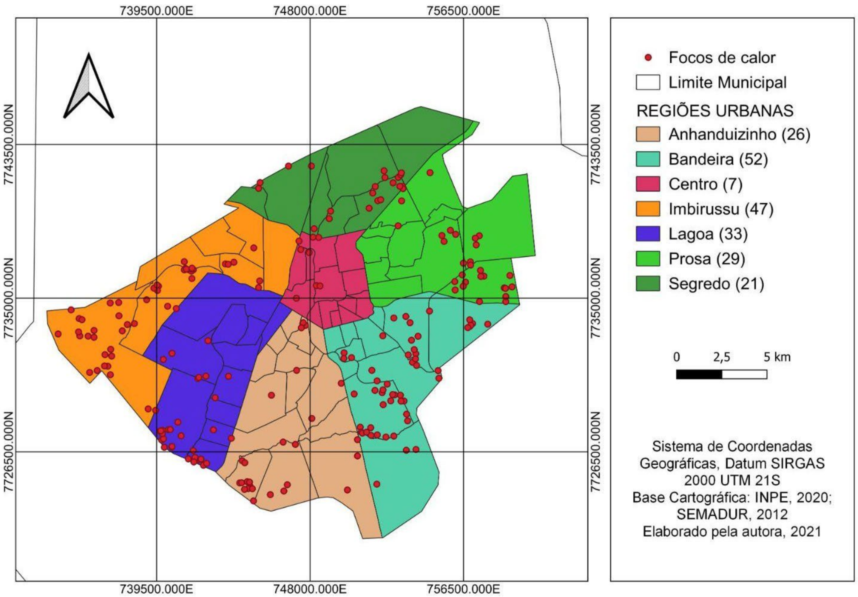

Figure 8. Heat spots by urban region in 2020

65, and also an increase in hot spots from 2019 to 2020, with 2020 totaling 215 hot spots. Thus, in relation to precipitation, we can note that the period 2018-2020 totaled 3,529mm.

With this, it is worth mentioning the urbanization rate of Campo Grande-MS, which, according to Ibge (1970-2010) cited in Planurb (2020, p.106), was 93.51% in 1970, 97.22% in 1980, 98.59% in 2000, and 98.66% in 2010. There is a slight increase in urbanization in Campo Grande, but this, associated with the habits of the population, contribute to the increase in the incidence of fires in the city.

hows a significant increase in hot spots from 2019 to 2020, from 913 to 1,547, and in the urban area, from 215 in 2019 to 220 in 2020, triggering attention in relation to impacts on human health through the aggravation of respiratory disease. In this sense, Table 2 shows the records of hospitalizations due to respiratory system diseases.

Table 3. Respiratory system diseases by place of admission inCampo Grande-MS

ICD-10 Morbidity List	YEAR							
	2014	2015	2016	2017	2018	2019	2020	TOTAL
Acute Pharyngitis and Acute Tonsillitis	-	4	3	2	4	11	7	31
Acute Laryngitis and Tracheitis	6	2	11	13	8	20	17	77
Other acute upper respiratory infections	16	12	13	23	18	17	12	111
Influenza [flu]	8	35	81	84	98	95	223	626
Pneumonia	2.869	2.574	2.679	2.479	2.326	2.695	2.039	17.661
Acute bronchitis and acute bronchiolitis	128	146	96	132	119	190	66	877
Chronic sinusitis	11	13	32	26	10	13	3	108
Other diseases of the nose and sinuses	82	127	100	85	76	52	32	554
Chronic tonsil and adenoid diseases	357	354	367	250	111	137	45	1.621

Other upper respiratory tract diseases	15	21	21	55	28	24	27	191
Bronchitis, emphysema and other chronic obstructive pulmonary diseases	142	156	206	207	209	212	177	1.309
Asthma	28	43	34	50	45	63	39	302
Bronchiectasis	1	1	7	5	33	26	1	74
Pneumoconiosis	7	4	5	8	4	3	1	32
Other respiratory system diseases	963	1.035	1.115	943	882	761	871	6.570
Total	4.635	4.527	4.770	4.362	3.971	4.319	3.560	30.144

Source: Updated by the author from DATASUS data, 2014-2020.

As per table 2, we can note that the respiratory diseases with more notifications in the municipality were: Pneumonia (17,624 notifications); Chronic diseases of the tonsils and adenoids (1,599 cases); Influenza (1,446); Bronchitis emphysema and other chronic obstructive pulmonary diseases (1,324); other diseases of the respiratory system, with a total of 6,509 cases. Furthermore, it is important to note that the year with the highest occurrence of respiratory diseases was 2016, totaling 5,661 hospitalizations compared to the total of 440 hot spots observed in 2016. In view of this, it is possible to observe in Table 3 the hospitalizations by year/month of processing, according to ICD-10 Morb List of Chapter ICD-10 X Respiratory Diseases in Campo Grande in the year 2016, because this year presented a higher quantity of hospitalizations compared to the other years within the period analyzed.

Table 4. Respiratory Tract Diseases by month of processing in the year 2016

ICD-10 Morbidity	MONTH OF PROCESSING												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Acute Pharyngitis and Acute Tonsillitis	-	-	1	-	-	-	-	-	1	1	-	-	3
Acute Laryngitis and Tracheitis	1	1	1	-	-	2	2	-	-	4	-	-	11
Other acute upper respiratory infections	1	1	-	-	1	2	1	1	3	2	1	-	13
Influenza [flu]	2	5	5	6	4	10	4	10	16	8	3	8	81
Pneumonia	161	122	176	185	272	252	338	255	244	265	199	210	2.679
Acute bronchitis and acute bronchiolitis	4	4	3	10	9	9	12	15	7	16	4	3	96
Chronic sinusitis	-	2	5	5	1	2	1	2	9	2	3	-	32
Other diseases of the nose and sinuses	11	8	10	6	8	12	15	9	3	5	7	6	100
Chronic tonsil and adenoid diseases	14	28	38	34	33	32	34	39	42	19	27	27	367
Other upper respiratory tract diseases	2	-	2	1	2	-	-	4	4	-	3	3	21
Bronchitis, emphysema and other chronic obstructive pulmonary diseases	13	11	14	10	8	13	16	20	23	26	20	32	206
Asthma	-	-	-	4	3	2	4	5	6	5	3	2	34
Bronchiectasis	-	-	1	-	-	-	3	-	-	2	1	-	7
Pneumoconiosis	-	-	-	2	-	-	1	-	1	-	1	-	5
Other respiratory system diseases	79	69	93	84	93	100	89	81	126	102	89	110	1.115
Total	288	251	349	347	434	436	520	441	485	457	361	401	4.770

Source: DATASUS, 2014-2020.

Based on table 3, it is possible to observe that the month with the highest number of hospitalizations was July, with 520 hospitalizations, and the month with the lowest number was February, with 251 hospitalizations. Regarding the disease that presented the highest number of hospitalizations in 2016, pneumonia totaled 2,679 hospitalizations from January to December of this year, and acute pharyngitis and acute tonsillitis had the lowest number of hospitalizations, totaling 3 hospitalizations. Compared to the number of hot spots in 2016, according to table 1, it is noted that the hot spots in the city of Campo Grande totaled 440, with annual precipitation of 1,564.6 mm.

Thus, it is possible to note that there is no direct relationship between hot spots and respiratory diseases, considering that the year 2020 had the highest number of hot spots, but the lowest number of hospitalizations for respiratory problems in the analyzed period. However, according to table 1, we can note that there is a direct relationship between heat spots and precipitation, with the year 2020 showing the highest number of hot spots and low precipitation.

In the city of Campo Grande-MS, according to Planurb; Campo Grande (2019, p.7), environmental education actions are carried out, such as the “Say no to Urban Burning” campaign. However, it is a recurring phenomenon, which may be associated with ineffectiveness in internalizing information and raising awareness in society. In this sense, it is important to advance scientific research on burning and health in Campo Grande.

Final Considerations

From the information on hot spots, precipitation and respiratory system diseases, the importance of scientific research on environmental issues is noteworthy, especially about the negative impacts of human action that trigger environmental degradation. Burnings and fires are responsible for the emission of particulate matter that directly influences the health of the population living near the burned areas, as well as the population of other regions. Another observed factor is related to the issue of deforestation that, associated with the fires, interferes with human health, as well as with the ecosystem and the climate.

Thus, it is necessary to emphasize that, based on the information obtained, it was not possible to observe a direct relationship between hot spots and hospitalizations for respiratory diseases in the period analyzed, considering that the year 2020 represented a higher number of hot spots, but fewer hospitalizations, a factor that may be related to the attention paid to the panorama triggered by the pandemic of COVID-19.

However, we noticed a relationship between hot spots and rainfall data, since the year 2020 showed a low precipitation index, with a total of 1,181.4 mm in the period analyzed, while the record precipitation of 1,201.4 mm in the year 2019 coincided with a high incidence of hot spots, totaling 913 hot spots. The burnings may be associated with urbanization in the case studied, due to the habits of the population that perform the burning of organic matter, associated with climate variability and meteorological weather conditions in the seasonality of the occurrence of the facts, enhancing the circumstances of involvement of respiratory diseases.

However, it is expected that from the initial development of this research, the triggering of analysis and reflection with greater depth thematic will occur to contribute to the discussion on burning and its impact on human health and the environment, as well as the development of critical environmental education actions in order to raise awareness and train environmental ambassadors in the city of Campo Grande-MS.

References

Araújo, F., De, . M., & Miziara, F. (2014). Análise da ocorrência das morbidades respiratórias e sua relação com a incidência de áreas queimadas para o estado de Goiás. *Boletim Goiano de Geografia. v*, *34*(1), 7-8.

Cartográfica, S. B., & Grande, C. (n.d.). Retrieved from `http://www.campogrande.ms.gov.br/semadur/downloads/base-cartografica/.Accessed`

Cemtec, & Semagro. (n.d.). Retrieved from `https://www.cemtec.ms.gov.br/boletins-meteorologicos/.Accessed`

Cemtec, & Semagro. (2014). Retrieved from `https://www.cemtec.ms.gov.br/boletins-meteorologicos/.Accessed`

Cemtec, & Semagro. (2015). Retrieved from `https://www.cemtec.ms.gov.br/boletins-meteorologicos/.Accessed`

Cemtec, & Semagro. (2016). Retrieved from `https://www.cemtec.ms.gov.br/boletins-meteorologicos/.Accessed`

Cemtec, & Semagro. (2017). Retrieved from `https://www.cemtec.ms.gov.br/boletins-meteorologicos/.Accessed`

Cemtec, & Semagro. (2018). Retrieved from `https://www.cemtec.ms.gov.br/boletins-meteorologicos/.Accessed`

Cemtec, & Semagro. (2019). Retrieved from `https://www.cemtec.ms.gov.br/boletins-meteorologicos/.Accessed`

Datasus, & Morbidade. (2014). Retrieved from `http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sih/cnv/nims.def.Accessedon:07/01/2021`

Fernandes, T. ., Hacon, S., Souza, . D., Novais, J. W., & Zangeski. (2021). Mudanças climáticas, poluição do ar e repercussões na saúde humana: Revisão Sistemática. *Revista Brasileira de Climatologia*, *28*, 138-164.

Gonçalves, K., Santos, ., Castro, H., De, . A., Hacon, S., & Souza, D. (2012). As queimadas na região amazônica e o adoecimento respiratório. *Revista Ciência &*(6), 1523-1532.

Gontijo, G. A., Batista, ., Pereira, A., Arantes, ., Oliveira, E., Júnior, F. D. S. D. A., & Weimar. (2011). Retrieved from `http://marte.sid.inpe.br/col/dpi.inpe.br/marte/2011/07.21.14.32/doc/p1587.pdf.Accessedon:07/01/2021`

Grande, P. C. (2019). Retrieved from `http://www.campogrande.ms.gov.br/planurb/wp-content/uploads/sites/18/2020/04/RELAT%C3%93RIO-CAMPANHA-QUEIMADAS-2019-SITE.pdf.Accessedon:07/01/2021`

Grande, P. C. G. P. S. D. C. (2020). Retrieved from `http://www.campogrande.ms.gov.br/planurb/downloads/perfil-socioeconomico-de-campo-grande-ms-edicao-2020`

Horn, M. G., & Coutinho. (n.d.). Retrieved from `http://repositorio.ufpa.br/jspui/bitstream/2011/9580/1/Dissertacao_ResponsabilidadeAmbientalQueimadas.pdf.Accessedon:07/01/2021`

(n.d.). Retrieved from `https://queimadas.dgi.inpe.br/queimadas/bdqueimadas#graficos.Accessed`

(n.d.). Retrieved from `https://queimadas.dgi.inpe.br/queimadas/portal-static/estatisticas_estados/.Accessed`

(n.d.). Retrieved from `https://queimadas.dgi.inpe.br/queimadas/portal-static/estatisticas_paises/.Accessed`

Ibge. (1970). Retrieved from `<http://www.campogrande.ms.gov.br/planurb/downloads/perfil-socioeconomico-de-campo-grande-ms-edicao-2020/>.Accessedon:07/01/2021`

Inpe, & Bdqueimadas. (2014). Retrieved from `https://queimadas.dgi.inpe.br/queimadas/bdqueimadas#exportar-dados.Accessed`

Junior, S. P., Costa, ., Silva, C. A., & Da. (2012). A Distribuição e a ocorrência têmporo-espacial das queimadas no Mato Grosso do Sul, uma análise através das imagens do Satélite NOAA-15. Revista Geonorte. *Climatologia geográfica. Available at*, 1-12.

Leão, R., Spolti, ., Ferreira, G., Silva, . D., Strauch, J. C., & Mercedes. (2020). Retrieved from `https://revistas.ufpr.br/raega/article/view/65810/41289`

.Accessedon:07/01/2021

Lopes, E., Reis, Nascimento, ., Silva, A., Patricio, . P., Peruchi, J., . . . Felipe (2018). (Vol. 36). Retrieved from https://www.revistas.usp.br/rdg/article/view/148048/149524.Accessedon:07/01/2021

Morello, T., Fonseca, ., Melo, A. W., De, . F., Silva, Sonaira, ., & Anderson, L. O. (2020). Retrieved from <https://www.researchgate.net/publication/341255603_COVID-19_e_queimadas_um_duplo_desafio_ao_sistema_unico_de_saude>.Accessedon:07/01/2021

Portal de Mapas. Base Cartográfica Contínua. Escala 1:250.000; BC250 versão 2019. (2019). *IBGE*.

Ribeiro, H. ., & Pesquero, C. (2010). Retrieved from https://www.scielo.br/pdf/ea/v24n68/18.pdf.Accessedon:07/01/2021

Silva, A., Da, . M. C., Mattos, I., Echenique, ., Ignotti, Eliane, . . . Souza, D. (n.d.). Material particulado originário de queimadas e doenças respiratórias. *Revista de Saúde Pública*, 345-352.