

Assessment of environmental perception of inhabitants of the municipality of Américo Brasiliense on thermal comfort and climate change

João Forte ^a, Eva Azevedo ^b

^a University Institute of Lisbon - ISCTE, Lisbon, Portugal, jota_panagassi@hotmail.com.

^b Federal University of Pernambuco – UFPE, Caruaru, Brazil, evamoraisazevedo@gmail.com.

Abstract. This research aimed to analyse the environmental perception of climate and the relationship with thermal comfort of adults who have lived in the city of Américo Brasiliense, Brazil. Thus, a questionnaire was created in order to understand the comfort that the participants felt in relation to the environment around them, in addition to the perception of this theme on a global and local scale and how they fit into this context. In this way, it was possible to compare responses and infer the participants' knowledge regarding the concepts of environment and climate comfort in the city. Through the analysis of these aspects in the questionnaire, it was noted that the perception of individuals regarding issues related to the environment, especially in the context of Climate change and the perception of the impact on their comfort and the environment around them, may vary due to the performance of the local government and the involvement of the people in a neighbourhood. It is noticed that respondents related their behaviour and actions in the environment in a different way, when analysed on a global and municipal scale. Therefore, it can be concluded that the sample population can understand the relationship between the environment, thermal comfort and the effect of urban afforestation on local comfort, in addition to the fact that public policies, encouraged by the government, can influence the perception population about the environment in which they live. Another point noticed was the fact that there is an impasse when people think about their roles in relation to the environment and climate change at a local and global level. Part of the interviewees believe that their daily actions in the local environment do not impact the environment when placed on a global scale, which, would be a relevant point that needs to be worked on more deeply.

Keywords. Environment, Thermal Comfort, climate change, environment perception.

DOI: <https://doi.org/10.34641/clima.2022.77>

1. Introduction

Humanity has been intensifying its urbanization process and its disorderly growth has generated the concentration of populations in cities. This factor increases the diversity and complexity of environmental problems, demonstrating the socio-environmental weaknesses and contradictions of industrial and technological development [1].

From this process of demographic intensification, cities have become predominant factors in the analysis of impact on the environment and climate change. As the population was concentrated in the same spaces, social problems began to arise from the lack of planning and infrastructure that the urban environment had, especially in the historical context of the 20th century. These social problems ended up

being added to by environmental problems, among them the lack of basic sanitation and the supply of basic goods and services such as electricity, for example, causing serious problems for the health system.

When looking at the context of the 21st century, there is a worsening of several points described in the last century, a factor that is aggravated due to half of humanity living in urban centres. By 2030, this number will reach 60%, and by 2050, the total should reach around 70%. In Brazil, the urban population already reaches 85%, making the Brazilian panorama different from the rest of the world. As cities grow in size and population, the difficulty of maintaining spatial, social, economic and environmental balance also increases [2].

Thus, it is important to understand the relationship between human beings and the environment, especially when referring to climate changes. Understanding this perspective becomes important to also understand the reason for processes and events by which environmental impacts occur. Therefore, carrying out a study of the environmental perception, focusing on thermal comfort and its impacts on the urban population is fundamental for a better understanding of the human-environment interrelationship, taking into account their expectations, satisfactions and dissatisfactions, judgments and conducts [3].

The definition for the term “environmental perception” can be based on a wide and complex range of concepts. However, it is assumed that its basis starts from a basic principle that is the relationship between man and the environment and, mainly, how each individual perceives, understands and acts within their own environment, according to their cultures and needs [4].

Therefore, It is important also point out that within a study of environmental perception, it is possible to perceive different important aspects of the relationship between man and the environment, and this fact makes it fundamental in terms of an evaluation tool, making that their investigation may provide subsidies for the elaboration of proposals and public policies in different fields [4].

The data from the investigative process of environmental perception come from factors entirely linked to the individual's life history. Among these factors, we can mention: schooling, culture and personal experiences, profession, relationship with the environment, among other factors. From the interpretation of this information, it is possible to understand how each individual live in the environment around them. It is possible to perceive what are its aspects such as ideas, values and identities, and the interaction of all these points allows the recognition of patterns, and environmental issues are not inherent to this fact [5].

1.1 Study area

Américo Brasiliense is a Brazilian municipality located in the central region of the state of São Paulo, located 289 km from the capital (Figure 1). According to IBGE, its population is estimated at 38,701 inhabitants [6].

The sugarcane industry is considered the biggest source of the city's economy. Located in the municipality, São Martinho plant is one of the largest in the country, considering the volume of crushed cane, and serves the national and international sugar and alcohol market. Also finding in the sugarcane residue a great source of energy generation. [7].

The municipality is involved in different historical, economic and cultural problems. As a small

municipality, it faces different management problems, mainly related to the search for greater sources of revenue and sufficient technical staff to meet the demand for tasks related to public management.

The region's climate is known for being dry, with high temperatures (above 40°C, in some summer seasons) and well-defined periods of rain. Being in a tropical climate region, high temperatures are present almost every year, which is one of the main points of thermal discomfort in both winter and summer periods [7].

Therefore, understanding how the population looks at environmental issues becomes a key factor for the creation of effective public policies and for a better structuring of departments to meet the sector demands. Thus, by creating better management for other areas that need technical support.

The present work had the objective of evaluating the opinion of people who live in municipality of Américo Brasiliense about how they understand the concepts that are related to thermal comfort and climate changes. The study sought to understand the relationship between the impacts of citizens' activities on the environment, as well as the cognitive and emotional relationship with it.

2. Research Methods

The present research was developed through the application of online questionnaires during the month of August and September 2020, covering a total of 50 citizens and former residents of the city, chosen at random. Due to Covid-19 pandemic, the questionnaire was only answered online.

Qualitative analyses were performed, due to the subjectivity and context of the responses provided by the participants, but quantitative methods were also evaluated, as the repetition of representative patterns of each response was accounted for. There was no intention to approximate the number of respondents to the universe of inhabitants of the city of Américo Brasiliense, considering that around 38 thousand inhabitants live in the municipality.

The sample number was defined in order to provide greater knowledge about the interviewees regarding thermal comfort in the city. This work does not intend to project generalizations from the data collected, but to qualify the representations of people who live or have lived in the municipality indeed.

Some terms in the questionnaire were replaced, for instance, the term “solid waste”, which was now called “garbage” to simplify the understanding of who was responding.

The answers to the questionnaire could be classified in different ways in order to seek the best type of answer for what is being questioned. Questions were

asked to be answered directly (Yes, No, Maybe), some were necessary objective and extensive answers. They were also asked to rate from 0 to 5, where 0 is considered the worst rating and 5 the best.

Each question was prepared and classified as objectively as possible to facilitate the answer of those who are not involved with environmental issues in their daily lives.

In this way, the basis of the structure of all the questions addressed in the questionnaire was planned in order to provide information that would help in the general understanding of how citizens understand some climate change factors and their impacts. Fundamental criteria such as the content, size, organization and clarity of the questions were observed to encourage the informant to respond to the questions addressed [8].

Another factor to be highlighted was in relation to the format and appearance of the questionnaire, which can also significantly influence the rate of return of what is being analysed [9]. The aforementioned authors also emphasize the importance of impartiality, and care must be taken not to influence or induce the subject to answer the questions, which are also observed in the construction of the questionnaire. We sought to elaborate all the questions in order to leave the options open so that the subjects could indicate some other information that they considered important to add in the survey [10].

In addition, they were clarified that they could refuse to participate in the investigation without causing any harm; that such participation would involve no financial cost. They were also informed that anonymity would be guaranteed in the dissemination of the results of this research, in order to seek the most honest opinion possible from the participant and that this academic work would be presented at scientific events and/or journals.

3. Results and discussions

Through the questionnaire, it was possible to reach people from different educational backgrounds (49% with higher education, 44.4% with high school, 4.1% post graduated and 2% others), different age groups and different neighbourhoods of the city.

When analysing the profile of those involved, it can be seen that the most representative age group is adults between 20 and 30 years old, corresponding to approximately 53% of the total number of respondents.

One of the points to be highlighted is the fact that it seeks to represent the majority of neighbourhoods in the municipality, so that it is possible to analyse the perception of people with different points of view, but who live in the same municipality.

Of the approximately 25 neighbourhoods in the city, 18 are represented in the study. Most responses were obtained from 3 neighbourhoods: *Jardim Primavera*, *Centro* and *Vila Cerqueira*. Both correspond to 48% of the participants.

An important point to note is the fact that this questionnaire was applied only to people from the urban area of the municipality. It was not considered participants from rural neighbourhoods, this is because the topics are based on environmental issues through the perception of people who live in urban areas. A different approach is needed for the perception of those who live in rural areas.

Through this questionnaire it was possible to understand what the investigated citizens understand and how they solve some issues related to thermal comfort and climate change in their routine. Important points were also raised regarding specific environmental factors, such as urban afforestation, relation between human being and landscape and environmental public policies.

3.1 Global and local perception about climate change

At first, we sought to analyse how the participants understand the importance of questions about the environment and climate change in a global context, and how important they are in the city context, as well. It was hoped to obtain an overview of the opinion and how important this topic is for the participants.

After analysing the answers, it was noticed that the population differs in the way of understanding on a global and municipal scale. In figure 1, it is shown how the citizens assess the importance of the environment and climate in the world:

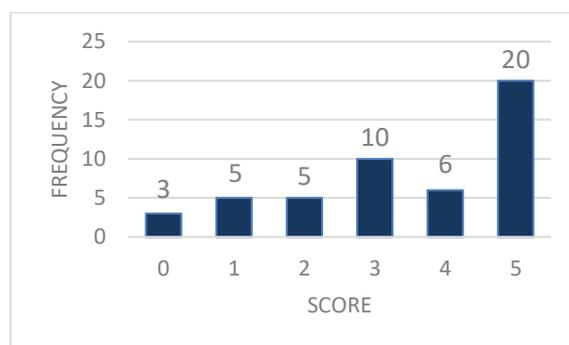


Fig 1 - importance of the environment and climate change in the world.

If you consider 3 a minimally satisfactory grade to clearly consider that people believe that the environment and climate can be considered important, there are 36 people (approximately 73%) who believe those topics are relevant for the planet, of those, 41% evaluating with grade 5 and 12.2% with grade 4. However, the same reality cannot be considered, when analysing people's opinion

regarding the importance of the environment in a local perspective, their opinions vary more significantly. Figure 2 shows that people's opinion changes in relation to the municipal context.

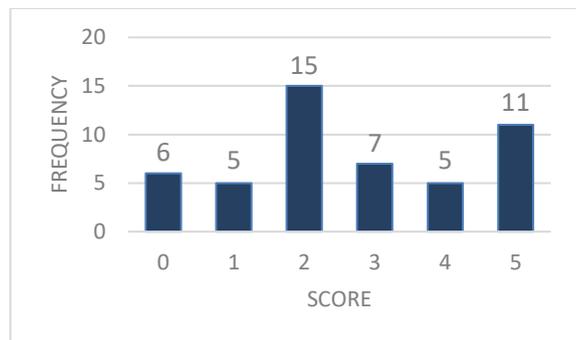


Fig. 2 - Question regarding the importance of the environment and Climate in Américo Brasiliense city.

In this perception, the number of people who gave at least one grade of 3 decreases, being only 23, corresponding to approximately 47% of people (less than the 73% in graph 2). Of these 23, only 11 (22.4%) rated 5 people and 5 people (10.2%) rated 4. Therefore, it is clearer that respondents evaluate differently the importance of the environment and climate to a global scale, than in a local one.

On one hand, those answer may be possible due to the fact that most of the participants do not consider environmental local impacts significant for the city. On the other hand, the global impacts are more significant and easier to be associated with climate changes.

Another relevant point in the questionnaire was the participants' perception of the municipality's environmental and climate policies. For this point, some questions were elaborated for this analysis. First, it was sought to understand how the participants consider to be important for the municipality to include those topics in municipal public decisions. If we consider that a grade of 3 or more is a score that demonstrates that the participant considers the environment and Climate change, at least, relevant, it is possible to see that only 61.2% of the listening population considers them relevant to municipal issues.

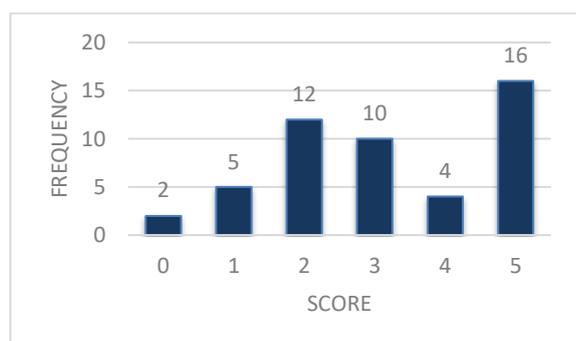


Fig 3 - Importance of the environment and climate changes for the local municipal public policies according to participants.

Another point to be analysed in the political question is how the city's citizens assess the importance that city politicians attribute to environmental issues. For this factor, it was asked, from 0 to 5, how much the participants believe that city politicians (councillors, mayors, among others) are concerned with environmental policies.

When considering, again, an evaluation from 0 to 5, grades 0, 1 and 2 as bad values on an evaluation, one can clearly see the population's discontent regarding the environmental issues that the municipality has been working on throughout its history. Figure 4 shows how the participants assess this context.

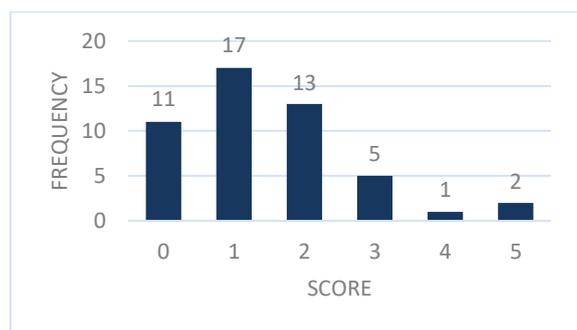


Fig 4 - Politicians' concern for the environment according to the citizens' view.

Taking into account 0, 1 and 2 as bad evaluations, it can be seen that approximately 41 people (83.7%) believe that those responsible for the public administration of the municipality do not care about environmental and climate change issues in the city and they make decisions that not take into account the environmental problems of the municipality.

The environment is an important factor in the context of social well-being, mainly on thermal comfort. The population suffers the consequences of negligence regarding environmental issues, so it is important to understand their point of view regarding these types of problems and find a way to spread knowledge about it.

Therefore, it is necessary to analyse the reasons that lead people to understand why they evaluate those involved in public management in this way, how they look at the environment and how the population understands their impacts on their neighbourhoods.

3.2 Relation between daily actions and consequences on the city's environmental impacts

Often, the relationship with the environment can be conflicting and the individual does not imagine that his actions impact the environment around him - either indirectly or directly. Sauv e states that it is necessary to create a relationship of belonging to the place where one lives, improving the socio-environmental relation between the individual and the environment and, in this way, developing a feeling of belonging to the place, thus establishing a

connection with what happens around you [11].

Therefore, we also sought to question whether the participant considers that their actions have a negative impact on the environment and Climate change.

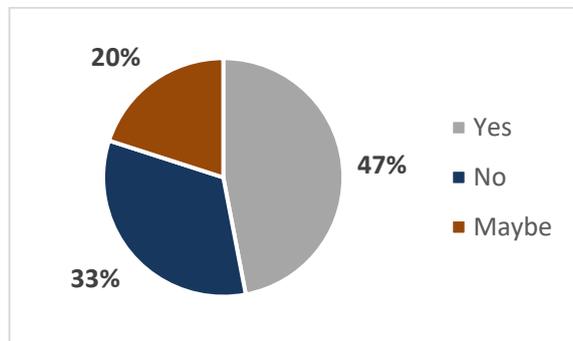


Fig 5 - Result of the question “Do you cause any damage to the environment in your daily life?”

When combining the option “No” and “Maybe”, it can be seen that 67% believe that both of them do not impact the environment around them or do not know how to inform if this occurs. Thus, many people consider that their day-to-day actions are not effective in providing an impact to the environment around them, while only a third of the participants believe that their actions have any impact on their daily actions.

Among those who answered “Yes”, the most cited damage to the environment is the production and generation of waste such as: Plastic bags, urban waste, and others such as the use of automobiles and, consequently, the pollution generated by their use.

When talking about thermal comfort, it is clear that some people do not realize whether their actions related to environmental issues can cause any significant impact on what they feel about the environment.

Therefore, they were asked about what they would change in the landscape of the place where they live and most consider urban afforestation as extremely important points to change regarding the surroundings where they are living. This demonstrates how the sample population of this work considers afforestation as a significant factor not only as a necessity, but as a way to change the landscape, making it more pleasant and comforting in terms of temperature.

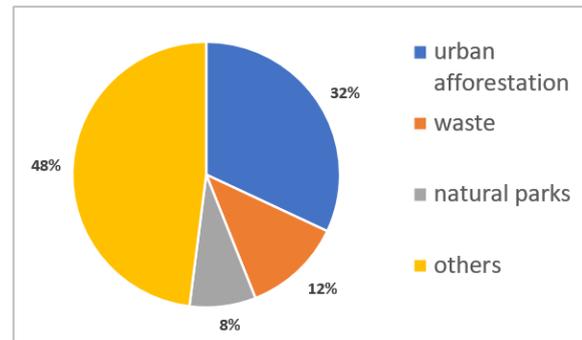


Fig. 6 - Answer to the question “Is there anything you would like to change in the landscape of the place where you live?”

An important fact to comment is that many people responded that they want to change something in the landscape in which they live, but either preferred not to confirm what they were or were not sure how to make this change, in addition to these, 10 people consider themselves satisfied with the place where they live. This variation in the answer can occur due to different factors, among them: Due to the difference in the location in which the participants reside, the time they spend in the place, for having lived at different times in the municipality, for the perception of the space around it and for the way in which interact with the environment and with the people around them. This point related to urban afforestation as a heat reliever can be perceived by the fact that even most of the participants would like to change the place where they live because the heat.

4. Conclusion

Analysing the participants, it was noted that the opinion on some concepts related to the environment varies according to the perception of each involved regarding the questions. People understand the environment as something important to preserve, but they vary in opinion about what to do to protect it.

Due to the fact that the important opinion of 50 people who live in the municipality was collected, it is possible to have an overview of how people perceive the topic addressed in the questionnaire, but it is still not possible to say that this opinion reflects the opinion of the entire local population. More responses are needed for this statement.

In the end, it was observed that the questionnaire provided the opportunity to know how the people of the municipality think about some environmental issues and what they believe are important for local environmental improvement.

In general, people believe that the environment and climate change are important to the world and, indeed, needs to be preserved, but when analysed on a local scale, in which actions can directly affect the environment in which they live, their perception of importance about the impact of their actions have on

the environment decrease significantly.

This can be seen when the environment in which the individual lives is considered less important than the environment in a global scale. Therefore, not assuming that the world is a system that depends on balance and that, by interfering with the surrounding microenvironment, it is also generating an impact on the macroenvironment as a whole.

It is noticed that some of the participants consider the importance of environmental public policies small in their day-to-day. This may reflect the fact that they do not consider that their daily lives are entirely dependent on climate change or environmental policies based on socio-environmental well-being. Therefore, as approximately 98% of respondents are over 18 years of age, it would be important to encourage environmental education policies focused on adults as well.

Because it was an open-ended question, the question "Is there anything you would like to change in the landscape of the place where you live?" demonstrates that 15 people have mentioned the theme of urban afforestation as a factor to be changed in the landscape is very significant. This shows how the government and population, should encourage stronger public policies in this area, as well as incentives to promote and maintain urban afforestation in the municipality as an important heat reliever.

A possible change related to the municipal environmental public policy that local politicians could carry out would be to encourage the planting of native trees in urban spaces through tax incentives. This could bring greater thermal comfort to local citizens, improve the biodiversity of species in the region, in addition to other benefits that would help the citizens' routine.

As future recommendations, it will be necessary to carry out a neighbourhood-by-neighbourhood analysis, with more answers, visits on-site interviews and with specific questions for each theme, in this way the results would be more accurate and more focused on a problem present in each of the locations.

5. References

[1] Ferreira J. Solid Waste and Hospital Waste: An Ethical Discussion. *Public Health Notebook*, Rio de Janeiro (BR). 1995;11(3):14-20;

[2] Ethos Institute. Sustainable Cities Program. São Paulo (BR). 2011;5(1):3-30.

[3] Villar L., Almeida A., Lima M., Almeida J., Souza L., Paula V. The environmental perception among the inhabitants of the northwest region of the state of Rio de Janeiro (BR). *Esc Anna Nery Rev*

Nursing.2008;1(1):285-90.

[4] Silva B. Evaluation of environmental perception of residents of rural communities of president kubitschek/MG. Dissertation (Master in Agricultural Engineering). Federal University of Lavras (BR), 2017:65-88;

[5] Miranda N., Souza L. Environmental perception in rural properties: Palmas (BR). *Mercator*. 2011;10(23): 171-186;

[6] Brazilian Institute of Geography and Statistics (IBGE). Database by municipalities in the Immediate and Intermediate Geographical Regions of Brazil [internet]; 2017. [Updated 2021 Nov 12]. Available from: https://www.ibge.gov.br/apps/regioes_geograficas

[7] Brazil. Municipality data - Américo Brasiliense, a sweet city [internet]. Américo Brasiliense (BR); 2021 - [Updated 2021 Oct 2]. Available from: <https://www.americobrasiliense.sp.gov.br/site/>

[8] Barros P., Lehfeld S. *Fundamentals of Methodology: A Guide to Scientific Initialization*. São Paulo: McGraw-Hill; 1986: 4 - 7.

[9] Thomas J., Nelson J.; Silverman S. Research methods in physical activities. *Brazil. Artmed*, 2007;1(1):11-15.

[10] Veiga T., Coutinho S., Takayanagui A. Evaluation of indicators for municipal solid waste management. *Electronic Journal Environmental Forum of Alta Paulista (BR)*. 2015;11(3):1-14;

[11] Sauvé L. Environmental Education: possibilities and limitations. *Education and Research. Brazil*. 2005;31(2):317-322.

The datasets generated during and/or analysed during the current study are not available because they are in the final stage of evaluation, but the authors will make every reasonable effort to publish them in near future.