

TOPOPHILIA AND ENVIRONMENTAL VALUATION OF URBAN FOREST FRAGMENTS IN AN AMAZONIAN CITY

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Introduction

Urban forest fragments (UFFs) are vegetation-covered areas that are isolated between artificially constructed spaces and are deemed strategic resources for improving the quality of life in cities, since the presence of vegetation cover mitigates the impacts caused by anthropic action (FEIBER, 2004; SOUZA, et al., 2013).

The forest vegetation is capable of providing the most varied ecosystem services to cities (ESCOBEDO, et al., 2011; LIVESLEY, et al., 2016; DAVIES, et al., 2017). These services are associated with the various ecological functions that vegetation can perform. Urban forests can have positive impacts on the water, microclimate, carbon and pollution cycles in urban ecosystems (LIVESLEY et al., 2016). In addition, plants “regulate humidity and air temperature; maintain soil permeability, fertility and moisture and protect them against erosion; reduce noise levels serving as a buffer from the noise of cities” (GOMES, 2005, p. 57); improve the city’s microclimate by generating shade and reducing wind speed; and, they provide shelter for the fauna, among other functions. At the same time, “from the psychological and social perspective”, the UFFs “influence the mood of the individuals, *en masse* with big cities’ disorder,” (GOMES, *op. cit.*) besides providing a pleasant environment for the practice of sports, physical exercises and recreation in general (LLARDENT, 1982). Forested areas also have a very important role in restoring the relationship between man and the natural environment (PIVETTA; SILVA FILHO, 2002; GOMES; SOARES, 2003; RIBEIRO, 2009).

Although the presence of areas with native vegetation in the cities is associated with quality of life, these areas are the most fragile elements of the urban landscape, since they directly suffer the negative impacts of the anthropic action represented by the pressures of

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urbanization and increasing population density (MELO et al., 2011). Manaus, capital of Amazonas state, is the main urban center of the western Brazilian Amazon. An example of an urban area developed in a region originally covered by dense and continuous forests that, with its disordered growth, had its forest areas reduced to fragments amid several neighborhoods and residential developments with high demographic density (FREITAS; RIBEIRO, 2007).

In addition to the legal powers necessary for the environmental governance of cities, the participation of local civil society, particularly neighborhood groups, is essential for the effective protection of UFFs (COLDING; BARTHEL, 2013; KUDO et al., 2016). However, neighborhood groups may develop an affection (topophilia) or dislike and aversion of (topophobia) these forest landscapes (TUAN, 1980). In Manaus, as in other metropolitan centers, there has been a growing mobilization by neighborhood groups for the preservation of UFFs. These mobilizations are for the purpose of protecting urban forests, since the advance of urbanization and consequent fragmentation and isolation of these natural spaces make them more valued and conducive to being occupied and developed.

Studies that focus on an environmental perception approach facilitate discussion of an important component for understanding the relationships between society and the environment in a given context (COSTA; COLESANTI, 2011). Environmental perception is closely tied to the historical and sociocultural processes of a particular group. The significance of the environment is built on the collective experiences and experiences of each individual person (KUHNEN; HIGUCHI, 2011). Then, from one's relationship with the environment, a subjective set of understandings is formed, that is, one's environmental values, and these, in turn, allow the person to interpret and act in, and interact with, the environment. The basic assumption is that these values are models that guide actions as much as attitudes, being more central than the latter (PATO-OLIVEIRA; TAMAYO, 2002).

Therefore, when one becomes aware of a particular person's values it becomes possible to predict how they would behave in various experimental and real-life situations. The assessment of environmental perception and valuation (AMORIM FILHO, 2007; KAHN; RIVAS, 2014) allows one to understand the socio-environmental behaviors of such groups and to plan management actions that facilitate their involvement in actions for the conservation of urban biodiversity. The objective of this study was to investigate the factors that influence the environmental valuation declared by residents adjacent to and distant from UFFs with respect to the retention of these components of the urban landscape of Manaus.

Methods

Study sites

The study was conducted in two urban forest fragments located in green areas in the city of Manaus: *Mundo Novo* (New World) and *Da Ilha* (of the Island). The *Mundo*

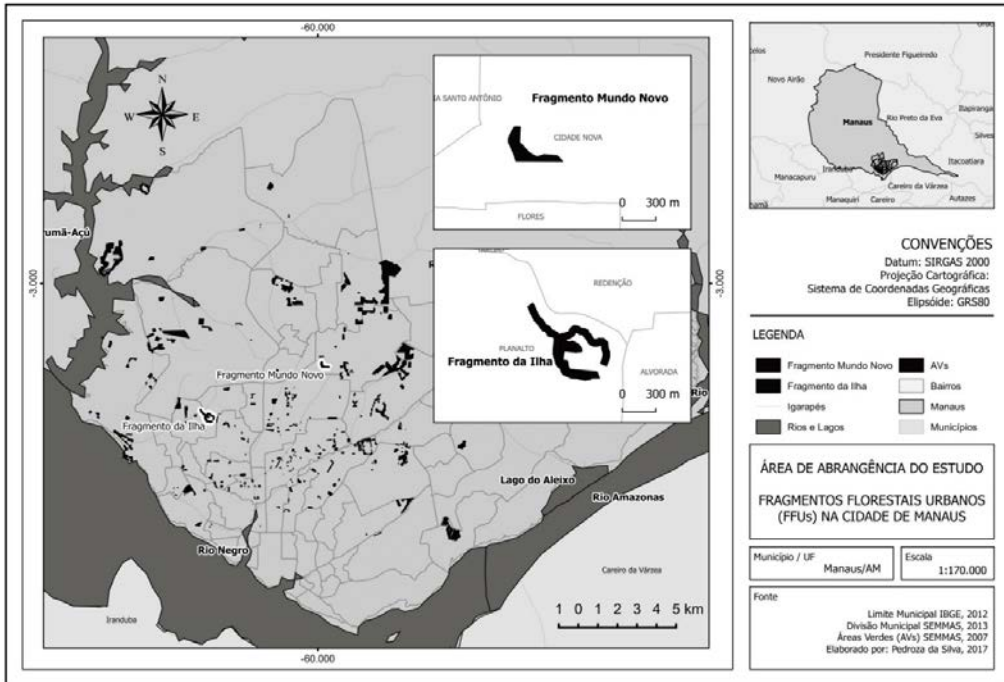
Novo fragment, with 8.9 ha, is located in the neighborhood of the same name, in the North Zone of Manaus. The neighborhood emerged from a housing financing project by the state government and was later spontaneously occupied (Figure 1). The *Da Ilha* fragment, with 13.22 ha, is located in the *Planalto* neighborhood, in the Center West Zone of the city and is surrounded entirely by planned areas. This neighborhood consists of six housing developments (*Vista Bela*, *Belvedere*, *Flamanal*, *Campos Elíseos*, *Jardim Versalhes* and *Da Ilha*) that give the place an urban infrastructure organized from an urban planning perspective, with designated urban green areas, wide avenues and well-marked streets (Figure 1). In both cases, only part of the UFF area corresponds to the designated urban green area registered in the development plan as permanently protected forest, that is, as public areas under the direct responsibility of the municipality. There was no urban planning intervention in these areas.

For the selection of the representative sample of the neighborhood groups, a sample of quotas per stratum was established (EPA, 2002). In order to define the strata, the location of the residence (distance) relative to the nearby neighborhood fragment was considered, and the surrounding population was classified into two strata: (1) adjacent dwellers (close to the boundary of the fragment) and (2) distant dwellers (more than two blocks, or streets, distant from the fragment). Near the *Mundo Novo* fragment 38 inhabitants were interviewed and near the *Da Ilha* fragment 31, totaling 69 interviewees, 55% of whom were female.

The information regarding the perceptions of the residents surrounding the urban forest fragments was obtained by conducting structured interviews. They consisted of a pre-established script of questions that can be applied flexibly at the time of the interview, allowing “a closer contact between the researcher and the interviewee”, that is, during the interview care must be taken not to run away from the questions, thus favoring an in-depth exploration of their knowledge (CHIZZOTTI, 2005). The interviews took place between July and November 2014.

The initial contact with the neighborhood groups was made through the distribution of a pamphlet with information about the content and purpose of the research and the invitation to participate. The residents who accepted the invitation had their interviews scheduled with the day and time determined by them. In each household, an adult resident of the neighborhood for more than five years was chosen, regardless of individual’s social characteristics. The Ethics and Research Committee of the Federal University of Amazonas approved the research project under the CAAE protocol: 32021914.8.0000.5020.

Figure 1. Map showing the locations of the urban forest fragments (UFFS) studied in City of Manaus, Amazonas, Brazil.



Source: Prepared by the authors.

Assessment of the Environmental Valuation of UFFs

For the assessment of the environmental valuation of the UFFs, we used the methodologies of pile sorting (WHALEY; LONGORIA, 2009) followed by ranking (KOZAK; CLIFF, 2013). Each interviewee received cards containing images expressing 14 different types of attributes that could be associated with the UFF (Table 1). In addition to the 13 attributes suggested by Brown and Reed (2000), the attribute “Eco-Ethical” was added to represent a clearly non-utilitarian and non-anthropocentric value.

TABLE 1 – DESCRIPTION OF SOCIO-ENVIRONMENTAL ATTRIBUTES CONSIDERED IN THE ENVIRONMENTAL VALUATION OF UFFS.

Socio-Environmental Attributes	Environmental value of the Urban Forest Fragment
Aesthetic (1)	I appreciate its landscape, images, smells and sounds.
Recreational (2)	A place for carrying out recreational activities such as long walks.
Biological Diversity (3)	Shelters a variety of organisms and land and water ecosystems.
Intrinsic (4)	Due to its existence itself, regardless of what others think about it.
History (5)	Natural places and human history important to me and to the community.
Future (6)	Future generations will know and experience the forest fragment as it is now.
Therapeutic (7)	Makes people feel better physically and mentally.
Cultural (8)	Transmits knowledge, traditions and a way of life of their ancestors.
Sustain Life (9)	Helps to produce, preserve, clean and renew air, soil and water.
Spiritual (10)	A sacred religious spiritual place to be revered and respected.
Economic (11)	Provides wood, fruits, firewood, hunting and other goods and services.
Learning (12)	Allows learning about the environment.
Subsistence (13)	Provides food and other supplies needed to sustain people's livelihood.
Eco-Ethical (14)	Non-human creatures who live within it also have the right to life.

Source: Adapted by the authors from Brown and Reed (2000).

Following the individual presentation of each card and explanations about the meaning of the attributes through examples, we asked the interviewees to create the groups (pile sorting): one group (pile of cards) for the attributes present in the UFF and another for attributes not present in according to their personal opinion/feeling (MUCELIN; BELLINI, 2007). After the groups were sorted, we asked the interviewee to organize the cards in order of importance in each group. After the ranking of the cards, we asked the interviewee to describe the reasons for the position of each card-attribute in a particular group and position.

For tabulating the data, we assign numerical values to each card corresponding to the card's ranking position in the pile. Cards representing present attributes received positive values, the one most important for the interviewee got the highest value. We gave negative values to the cards representing absent attributes, the least valued attribute got the lowest negative value. Thus, if the interviewee said that all 14 attributes were present in the fragments, cards would receive values from 1 to 14 and the sum of these values represents a measure of topophilia or topophobia of the resident relative to the UFF in the neighborhood.

In addition to the independent variables "Fragment" and "Stratum", we considered the following socioeconomic variables: time as a resident (years), age (years), gender (binary), monthly income (by category) and schooling (by category). The relationship between the explanatory variables and each of the attributes was tested through correlation,

Student's t-test and ANOVA, for the continuous, binary and category-based variables, respectively. In order to verify that socioeconomic factors influence the total valuation of the socio-environmental attributes of the UFFs, a multiple linear regression analysis was performed, taking as explanatory variables: Age, Gender, Time as a Resident, Schooling and Income, and as a variable response to "Sum of Rankings" assigned by each resident. We use the PAST program version 3.14 (HAMMER et al., 2001) to run exploratory and statistical analysis.

Results and Discussion

Environmental Perception of UFFs

Most of the residents (59%, N = 69) mentioned positive feelings (topophilia) regarding the location and proximity of the forest fragments. Among the advantages highlighted in the interviews, what stood out, among other factors, were improvement of environmental quality, proximity to nature and beautification of the place.

On the other hand, the disadvantages or feelings of aversion (topophobia) mentioned were related to the perception of the UFF as a space "without infrastructure" that served as: a refuge for thieves and drug users; for the dumping of household waste in inappropriate places; for the proliferation of larvae and insects harmful to human health; as well as the proximity to and contact with venomous animals that use such spaces for shelter. These concepts reflect important elements that underlie many practices of aversion to forest fragments in the city, even if they are considered important, useful and pleasant (HIGUCHI et al., 2012). Both topophilia and topophobia are terms that reflect the affection or aversion that a person or a certain social group have with respect to certain places, spaces or even landscapes (TUAN, 1980).

In the Ranking analysis, the highest positive values were achieved by the "eco-ethical" attribute (14), followed by "biological diversity" (3), "future" (6), "sustain life" (9) and "intrinsic" (4) (Figure 2). According to the theory of total economic value, these values could be classified as Non-Use Values or Values of Existence (MOTTA, 2011). People attribute value to a natural resource even if they do not consume it, because they are altruistic towards friends, family members, fauna and flora, future generations, and because they believe that nature has the right to exist (BISHOP; WELSH, 1992).

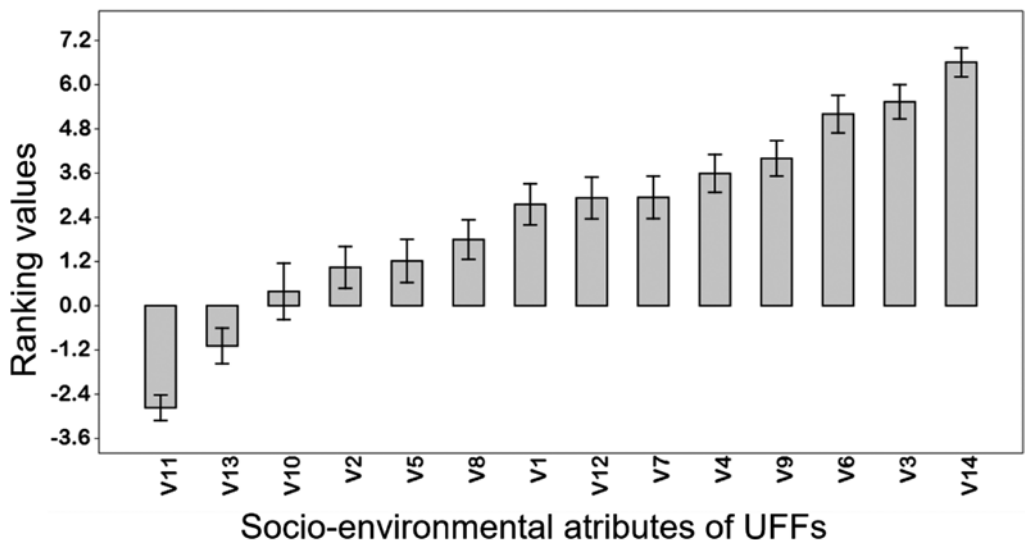
These attributes are decoupled from use (although they represent environmental consumption) and arise from a moral, cultural, ethical, or altruistic position regarding the right to exist of species other than humans, or other natural resources, even if they do not represent current use or future for anyone, which we could observe in the light of these presented results. They are associated with an ecocentric vision of UFFs, which considers nature as endowed with ecological values and reflected in human experiences related to feelings about the natural environment; humans are connected to nature and values it for its own sake (COELHO et al., 2006). In fact, the Manaus UFFs are valuable protected areas because they provide shelter to several species of native flora and fauna,

including the primate Brazilian Pied Bare-faced Tamarin (*Saguinus bicolor*), a species endemic to Manaus and critically endangered (SANTOS et al., 2017).

Among the attributes that received positive intermediate values are the attributes “Therapeutic” (7), “Learning” (12), “Aesthetic” (1), “Cultural” (8), Historical (5), Recreation (2), and, finally, “Spiritual” (10). It can be said that these attributes are associated with an anthropocentric or humanistic view of UFFs (Figure 2). Costa Neto, et al. (2010), asked more than 3,500 residents of Manaus what are the objectives of urban protected areas and obtained as the most frequent responses the association of these areas with leisure and physical exercise activities. It can be said that such attributes are associated with an anthropocentric or humanistic view of the UFFs. Residents who share this view are motivated by their interest in maintaining quality of life, health and human existence. To this end, they recognize that it is necessary to preserve the natural resources and integrity of ecosystems; so there is a mutually beneficial relationship, in which man preserves nature as a leisure space (for recreation) and primarily for his spiritual benefit.

On the other hand, attributes such as “subsistence” (13) and “economic” (11) were those that received the most negative values (Figure 2), indicating that urban dwellers do not value forest fragments for the direct and consumptive use of their environmental resources, as do the rural populations of the region (ALMEIDA et al., 2013).

Figure 2 - Bar graph indicating the mean standard error associated with the ranking values of 14 socio-environmental attributes assessed by the those who reside in the vicinity of two urban forest fragments in Manaus.



Note: Aesthetic (1), Recreational (2), Biological Diversity (3), Intrinsic (4), Historical (5), Future (6), Therapeutic (7), Cultural (8), Sustain Life (9), Spiritual (10), Economic (11), Learning (12), Subsistence (13) and Eco-Ethical (14).

Source: Prepared by the authors.

Most of the interviewees mentioned not using the forest fragment for economic (93%) or subsistence (71%) purposes, and the ranking distribution of these two attributes had a strong correlation ($r^2 = 0.50$, $p < 0.001$). Some residents associated the valuation of the “economic” attribute with the destruction of the area. As expected, both attributes were assessed relative to the direct consumption of the natural resources of the UFFs:

*“I never took anything from there nor do I make a living from it.”
“Because just thinking about wood I think it’s going to be destroyed, because cutting, exploiting the forest, that’s an environmental crime.”*

The “spiritual” attribute had the highest variation in ranking values among the residents, but it was strongly correlated with the ranking of the “therapeutic” attribute ($r^2 = 0.50$, $p < 0.001$). The statements were divergent regarding these attributes. Some residents interpreted the attribute “spiritual” as something associated with the practice of religious rituals in the place, others associated it with a feeling of inner peace or regarding the divine presence, according to reports such as:

“Because I’ve never done these spiritist things there and that does not make any difference to me.”

*“Only if it’s for those who practice macumba.”
“I think God is there; we feel the peace of mind.”*

“A good energy, a natural energy. We enter feeling down and we come out healed, they are the spirits of good.”

“[the therapeutic attribute] ... is linked in spiritual value to me. When we are in nature we feel good and feel like someone else.”

Two other attributes that presented a strong correlation were the attributes “Future” and “Learning” ($r^2 = 0.50$; $p < 0.001$). For the residents, the retention of the fragment in the neighborhood and its preservation are the guarantee that future generations will be able to get to know and learn to value these natural spaces.

“[learning] ... Because we can learn a lot there, and teach our children the value of life, the importance of having a green one.”

“[future] ... So that my children can learn what a forest is, so that their children, grandchildren will know.”

The results of this research corroborate the studies carried out by Brown and Reed (2000), in which the attributes “sustain life”, “biological diversity” and “future” were among the five most frequent values, while the “spiritual” attribute was one of the least valued, ranking 12th out of thirteen.

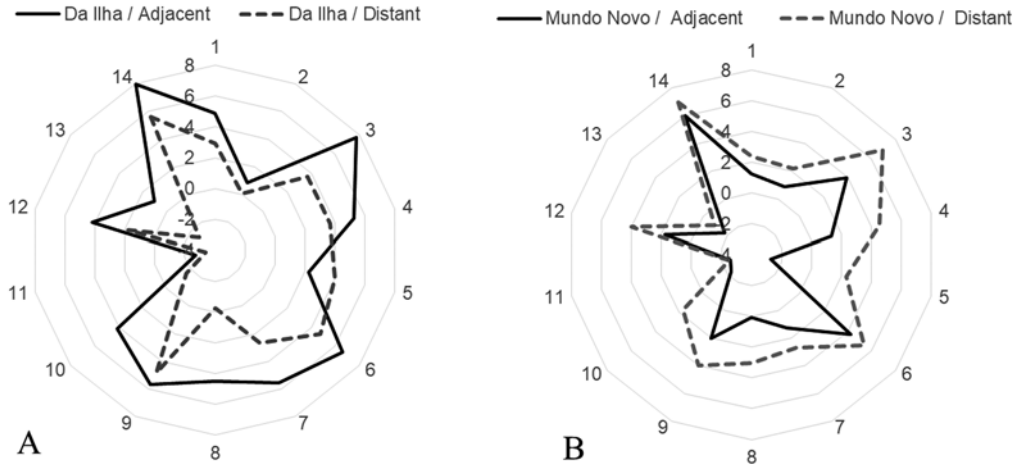
Age and time as a resident are slightly correlated independent variables ($r^2 = 0.45$, $p < 0.001$), since older people tend to be longtime residents. The correlation of these variables with the rankings of the attributes was verified and it was noted that people who are older, with more years as residents, tend to value more positively the “Spiritual”, “Historical” and “Cultural” attributes. However, the “time as a resident” variable was still correlated with the attributes “Therapeutic” and “Eco-Ethical”, while the age variable was also associated with the “Intrinsic” attribute. For the other socioeconomic variables, Gender, Schooling and Income, no significant association was found with the rankings of the individual attributes, indicating that these variables do not influence the way in which the inhabitants value the socio-environmental attributes of the forest fragments of their neighborhoods.

In the multiple regression analysis, having the degree of topophilia of the residents as a dependent variable and the socioeconomic variables as dependent variables, all response variables presented a non-significant regression coefficient ($p \gg 0.05$), except for the variable of “time as a resident”. Thus, a simple linear regression analysis was performed between the variables “time as a resident” and the degree of topophilia (the sum of the rankings of each resident, $N = 69$). Although the correlation between the variables could be considered very weak ($r^2 = 0.093$), this association was significant ($p = 0.011$), indicating that among the variables studied the best explanation for the difference in environmental valuation among residents is the amount of time they have interacted with the landscape of the fragment.

Considering the average of the ranking of each attribute assessed by each neighborhood group separately, one observes that the environmental factor “distance between residence and fragment” strongly influenced the residents’ perceptions (Figure 3). While in the “Da Ilha” fragment (the Center West zone) the adjacent residents tended to value the fragment more highly than the distant residents, the opposite was observed with the *Mundo Novo* fragment (North zone), probably due to the association that these residents make between the presence of the FFU and the violence and crime in the neighborhood.

The 2 x 2 factorial ANOVA served to test these differences between fragments and housing stratum and the interaction between these factors. For this analysis, the dependent variable was the sum of the rankings of socio-environmental attributes assessed by each resident for their respective FFU. The factors alone were not significant (“Fragment” $p = 0.052$, “stratum” $p = 0.8101$), indicating that the way in which residents assess socio-environmental attributes does not vary between fragments and strata. However, it was observed that the interaction between the factors was also significant ($p > 0.01$), which means that the difference in valuation between the housing strata does not have the same behavior if the fragments are considered separately and vice versa (Figure 4).

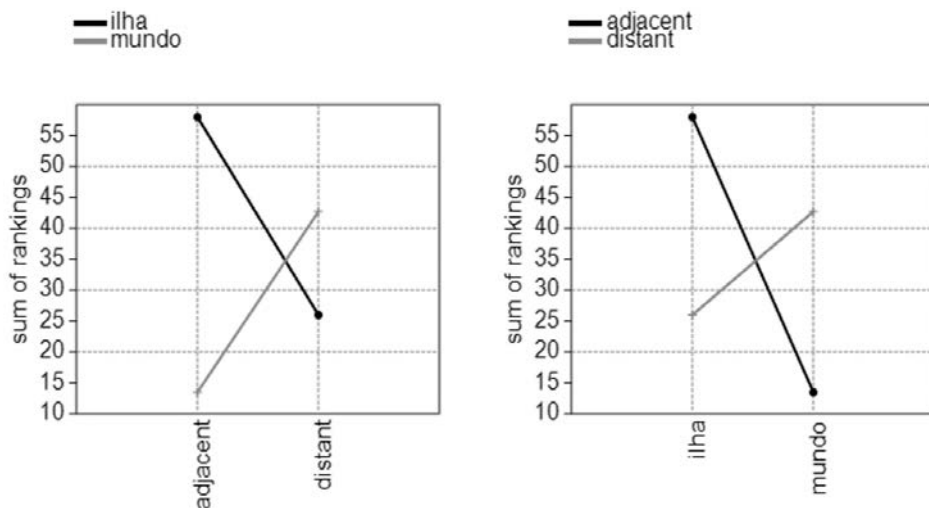
Figure 3 - Averages of the rankings of socio-environmental attributes by assessed fragment (“Da Ilha” - A and “Mundo Novo” - B) and by housing stratum (Adjacent and distant).



Attributes: Aesthetic (1), Recreational (2), Biological Diversity (3), Intrinsic (4), Historical (5), Future (6), Therapeutic (7), Cultural (8), Sustain Life (9), Spiritual (10), Economic (11), Learning (12), Subsistence (13) and Eco-Ethical (14).

Source: Prepared by the authors.

Figure 4 - Graph of mean rankings by housing stratum (A - Adjacent and distant) and fragment (B - “Da Ilha” and “Mundo Novo”) of the sums of the socio-environmental attributes’ rankings according to the assessment by each resident.



Source: Prepared by the authors.

These results demonstrate that topophilic feelings are nullified, or not developed, among residents who associate forests in the urban landscape to incidents of violence and crime. When the neighborhood group realizes that public space does not provide security, it tends not to value its preservation or existence. The lack of safety was also deemed to be the main negative aspect reported by students visiting the public parks of Manaus (VIANA et al., 2014).

Conclusions

By studying the environmental perceptions of neighborhood groups it was possible to distinguish significant differences in the socio-environmental values assigned to the UFFs studied in the city of Manaus.

Regardless of the context (fragment) and distance (adjacent or distant residents), the time spent living near the fragment was the main factor that determined the way in which residents value UFFs in their neighborhoods.

Residents in the neighborhoods of the UFFs tend to consider principally, that these environments are endowed with ecocentric values. Then, UFFs are seen as resource spaces endowed with non-consumptive use values, that is, resources that should be enjoyed for anthropocentric or humanistic purposes.

For the residents of Manaus, UFFs do not represent consumptive direct use environmental resources, that is, resources whose uses derive from forms of consumption that reduce the quality and availability of natural resources. This can be verified by the low ranking values assigned to economic and subsistence attributes.

The proximity of the fragment can result in “well-being and beauty” for the inhabitants or in “devaluation” (topophobia) of the natural space, due to the sensation of a lack of safety. In this way, the city dwellers demand that the management of the UFFs be more effective, in order to maintain the existence of these environments in the city and ensure their public use with safety.

The implementation of monitoring and surveillance programs associated with management to conserve and recognize the environmental value of these UFFs is likely to encourage the population to engage in environmental protection actions and thus is likely to ensure the maintenance of these green areas in the city.

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Submitted on: 19/07/2017

Accepted on: 18/12/2017

<http://dx.doi.org/10.1590/1809-4422asoc170159vu18L1AO>

2018;21:e01590

Original Article

TOPOPHILIA AND ENVIRONMENTAL VALUATION OF URBAN FOREST FRAGMENTS IN AN AMAZONIAN CITY

Abstract: The factors that can influence the environmental valuation of urban forest fragments (UFFs) in two neighborhoods of the city of Manaus (AM) were assessed. The valuation data were obtained through the technique of pile sorting followed by ranking, considering 14 socioenvironmental attributes. Most of the residents (59%, N = 69) mentioned positive feelings (topophilia) regarding the conservation of the fragments in the urban landscape. The attributes associated with the ecocentric vision were those that received the highest positive values, followed by anthropocentric attributes associated with the direct non-consumptive use of environmental resources, such as “aesthetic” and “learning”. Residents who live closer tended to value the fragment more than distant residents, and the opposite occurred when there was an association between the presence of the fragment and violence and crime in the neighborhood. Among the socioeconomic variables investigated, only the time as a resident seemed to be related to the way the city residents value these forest remnants.

Keywords: environmental perception, topophobia, time as a resident.

Resumo: Avaliaram-se os fatores que podem influenciar a valoração ambiental de fragmentos florestais urbanos (UFFs) em dois bairros da cidade de Manaus (AM). Os dados de valoração foram obtidos mediante a técnica de agrupamento de cartões seguida de ordenamento, considerando-se 14 atributos socioambientais. A maioria dos moradores (59%, N=69) mencionou sentimentos positivos (topofilia) em relação à permanência dos fragmentos na paisagem urbana. Os atributos associados à visão ecocêntrica foram os que receberam os maiores valores positivos, seguido de atributos antropocêntricos associados à usos diretos não consuntivos dos recursos ambientais, tais como “estético” e de “aprendizagem”. Moradores mais próximos tenderam a valorizar o fragmento mais do que os moradores distantes, ocorrendo o inverso quando houve associação direta entre o fragmento e a violência e a criminalidade na vizinhança. Dentre as variáveis socioeconômicas investigadas, apenas o tempo de moradia pareceu estar relacionado com o modo como os cidadãos valorizam esses remanescentes florestais.

Palavras-chave: Percepção ambiental, Topofobia, Tempo de moradia.

Resumen: Se evaluaron los factores que pueden influir en la valoración ambiental de frag-

mentos forestales urbanos (FFU) en dos barrios de Manaus (AM). Los datos de valoración se obtuvieron mediante la técnica de agrupamiento de tarjetas seguida de ordenamiento, considerando 14 atributos socio ambientales. La mayoría de los habitantes (59%, N = 69) mencionaron sentimientos positivos (topofilia) en relación a la permanencia de los fragmentos en el paisaje urbano. Los atributos asociados a la visión ecocéntrica fueron los que recibieron mayores valores positivos, seguido de atributos antropocéntricos asociados a usos directos no consuntivos de los recursos ambientales, tales como “estético” y de “aprendizaje”. Los residentes más cercanos tienden a valorar el fragmento más que los vecinos distantes, ocurriendo lo inverso cuando hubo asociación directa entre el fragmento la criminalidad en la vecindad. Entre las variables investigadas, sólo tiempo de vivienda pareció estar relacionado con el modo en que ciudadanos valoran remanentes forestales.

Palabras clave: Percepción ambiental, Topofobia, Tiempo de vivienda.
