

PAA Website Title

**Perception and Behavior Concerning the Environment: A multidimensional measure
of environmental perception using Grade of Membership**

New title

Self-interest versus Collective Action: Understanding Cross-Class Environmental
Perception and Behavior in Brazil

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Draft version

Comments welcome

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Introduction

Since the 1960s, when Rachel Carson's "Silent Spring" (Carson, 1962) called people's attention to controversial uses of chemical products and their environmental impact, public opinion has become more sensitive to the relationship between human activities and the natural environment. Questions such as global warming, ecological degradation, and ecosystems resilience became theme of several global conferences promoted by the United Nations. In 1983, the Brundtland Commission gave birth to the concept of "sustainable development"¹, reflecting public recognition of the environment as a key dimension of social development (White and Hunter, 2009).

Responding to the increasing level of public awareness about vulnerability to environmental hazards, questions like the effect of greenhouse gases and climate change on human populations defined an important share of policy agendas during the 1990's. As a result, studies about the role of the environment for broader social development rapidly increased (Dunlap and Mertig, 1995; Inglehart et al., 2000; Ester et al., 2004). One of the most influential studies about environmentalism was published by Inglehart in 1995 using the World Values Survey. Based on a series of correlational analysis of countries with different levels of socioeconomic development, the author concluded that variation in environmental concern and willingness to engage in conservation was explained by the dichotomy "materialistic versus post-materialistic view" (Inglehart 1995). Other influential study was conducted by Dunlap and Mertig (1995), using the 1992 Health of the Planet Survey. The authors' findings contrast with Inglehart's study, suggesting that concern for environmental quality is actually higher among developing countries. Although cross-national comparisons helped to situate the overall level of awareness in different societies, important differences in specific low-income settings were glossed over. More recent studies tried to fill this gap in the literature, conducting surveys in areas such as China, Brazil, Israel and Africa (Chen et al., 2011; Crespo, 2003; Drori and Yuchtman-Yaar, 2002; White and Hunter, 2009). These studies find environmental concern and willingness to pay for environmental conservation among low-income countries, although socioeconomic affluence is still important to reduce the cost of environmental action.

Mapping and measuring environmental values and perceptions is relevant because they express current social knowledge about environmental questions, as well as willingness to engage in behavioral changes in face of environmental problems, as suggested by the empirical literature. This kind of change, however, is not easy since it depends on a large number of social and economic factors that may prevent individuals to engage in environmentally significant behaviors. In this paper we measure and describe perceptions and behavior about several environmental issues using the Grade of Membership (GoM) technique, and discuss how these perceptions can be influenced by the physical characteristics of households and their socioeconomic status. We use a household-level survey representative of two metropolitan regions in the State of São Paulo, Brazil. The

¹ The concept of "sustainable development" was coined during the World Commission on Environment and Development (WCED), convened by the United Nations in 1983. The concept is generally used to mean use of natural resources that meets the needs of the present without compromising the ability of future generations to meet their own needs (Charles and Gareth, 1998).

questionnaire was designed to be comparable to other important surveys, such as the World Values Survey and a survey conducted by the Brazilian Ministry of the Environment (MMA, 2001). We take advantage of the standardized nature of the questionnaires in our two study sites to create multidimensional profiles that link perception to action regarding environmental problems. In addition, we include sociodemographic variables and infrastructural characteristics of the households and neighborhoods to discuss how perceptions and actions are mediated by social status, education and the immediate physical household environment. Because variables used in our profiles are readily available in other surveys, results for other settings can be compared in the future, contributing to a more general understanding of how perceptions and actions are linked and what factors may disrupt this connection.

This study contributes to the literature in two important ways: (1) methodologically, by using fuzzy state models to define fuzzy-weighted multidimensional profiles of environmental perception and behavior; and (2) substantively, by providing empirical evidence of perception and behavioral patterns regarding environmental problems in developing settings. The fuzzy set methodology allows us to empirically derive a measure of individual heterogeneity used to weight the probabilities used in the description of the multidimensional profiles. This measure of individual heterogeneity can also be used in future analysis to estimate regression relationships, adding more variance and increasing the explanatory power of statistical models when the observed variables are categorical (Manton et al., 1992). Last but not least, our empirical analysis adds to the growing literature on environmentalism in developing countries (Chen et al., 2011; White and Hunter, 2009; Drori and Yuchtman-Yaar, 2002). We argue that past evidence on low levels of pro-environmental behavior in low-income settings may reflect the inability of differentiating private (individual) from public (collective) environmental behavior. We address these limitations by including questions about actual and intended environmental behavior that explicitly differentiates individual from collective actions. As it will be seen, this difference is key to understanding how low-income individuals overcome budget constraints, reducing the unitary cost of action.

The Research Project

This paper is based on data from the Project *Dinâmica intrametropolitana e vulnerabilidade sócio-demográfica das metrópoles do interior paulista: Campinas e Santos*, conducted by Núcleo de Estudos de População (NEPO/UINICAMP), funded by FAPESP and CNPq research agencies. The survey was conducted in the second half of 2007, with a total of 3,419 households being interviewed (1,823 in Campinas Metropolitan Area and 1,596 in Baixada Santista Metropolitan Area). With seven modules², the questionnaire was designed primarily to elicit information about household level decisions and characteristics, although some questions at the individual level were asked (mainly

² For detailed information on the project, please refer to the following link: <<http://www.nepo.unicamp.br/vulnerabilidade/index.php>>.

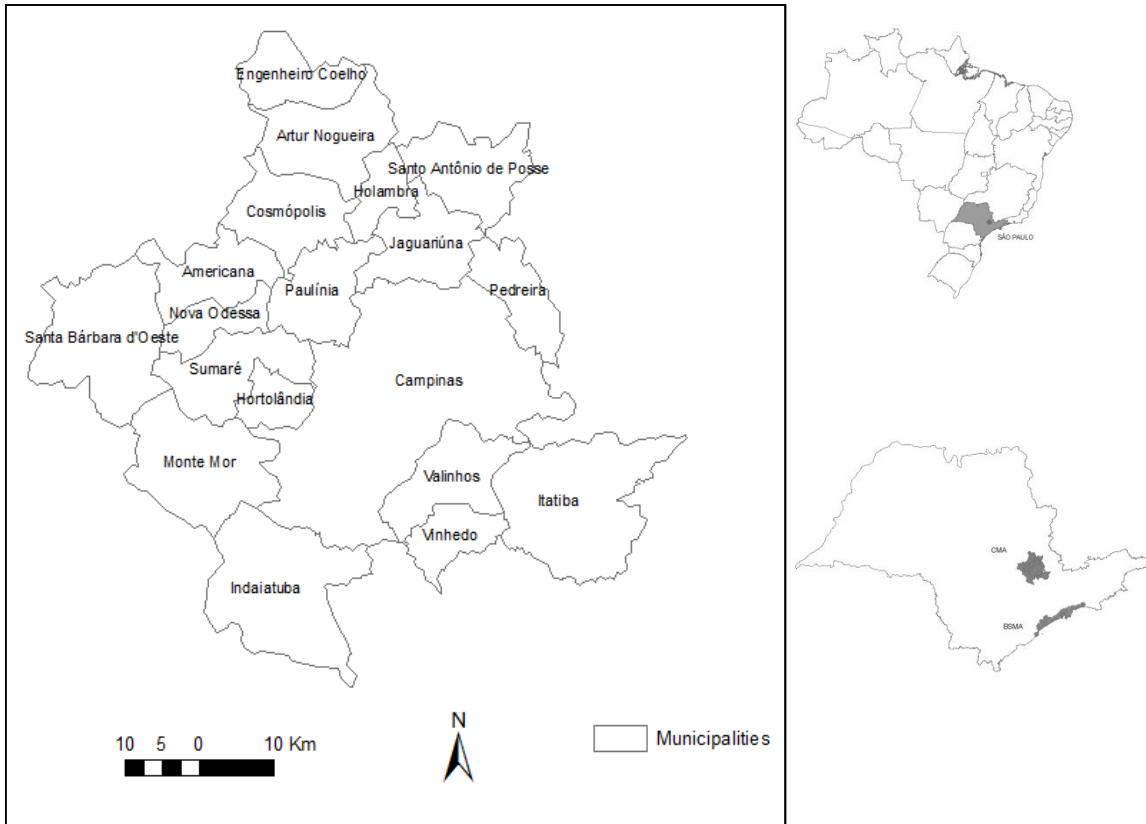
socio-demographic characteristics of household members)³. In this study we use the module with information for physical characteristics of the household and its surroundings in addition to questions about environmental attitude, knowledge, perception and behavior of respondents. The reference date of the survey is close to the release of IPCC Report (IPCC, 2007). The report suggested two relevant points: 1) global warming is scientifically proved to be happening, and 2) recent global warming is a result of human action. The release of the report and discussions following report's conclusions may have influenced the results observed in the data, specially the questions regarding environmental knowledge.

Research Sites

The questionnaires were conducted in two different metropolitan areas of São Paulo hinterland: Campinas and Baixada Santista. The Campinas Metropolitan Area (CMA) was officially established in 2000, comprising 19 municipalities (Figure 1). In 2010, CMA had an estimated population of 2.8 million inhabitants, 97.5% living in urban areas. Campinas alone, the metropolitan center, concentrated 1.1 million of residents. In the last decade, the demographic growth of the suburbs responded to almost the entire population increase observed in CMA. CMA is ranked as the third main economic area in Brazil, after São Paulo and Rio de Janeiro. Air pollution is a special environmental threat for residents of CMA, springing from three main sources: (1) a large oil refinery and petrochemical industrial complex in the municipality of Paulínia; (2) heavy car and truck traffic in two of the most important Brazilian roads (Anahnguera and Bandeirantes) crossing the metropolitan area, and (3) the burning of sugar-cane plantations to produce sugar or ethanol.

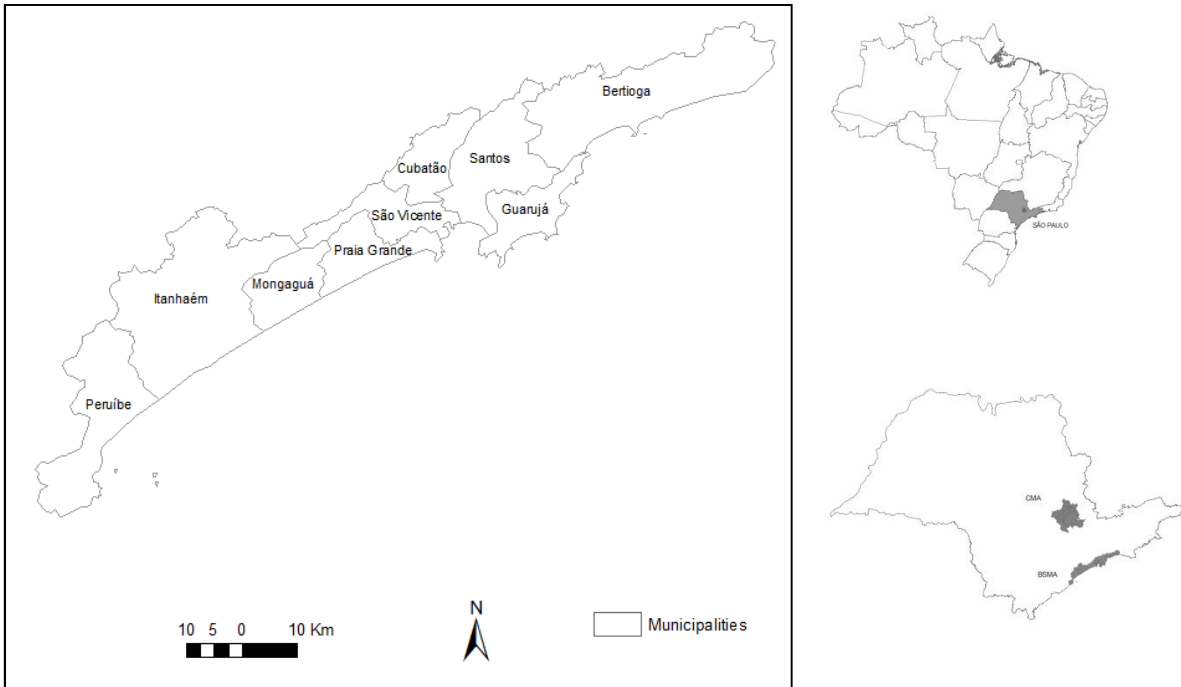
Figure 1: Campinas Metropolitan Area

³ The sample was drawn in three stages: first, strata of socioeconomic vulnerability were assigned; second, within each stratum, census tracts were selected proportionally to their size; third, a fixed number of households were selected within each selected census tract. We used the stratum and inverse of the probability of each household to be selected to estimate our results and adjust for the complex sampling design. For detailed information about the sampling procedures and questionnaire modules, see Cunha et al (2006).



The Baixada Santista Metropolitan Area (BSMA) was officially recognized in 1996, comprising 9 municipalities (Figure 2). In 2010, BSMA had an estimated population of 1.6 million inhabitants, with 99.7% of its residents living in urban areas. Different from CMA, BSMA is a coastal zone contoured in the back by a protected area – Serra do Mar (Mountain Range of the Sea). The topography of BSMA represents a physical barrier to the horizontal expansion of its municipalities and influences the level of environmental vulnerability each municipality is exposed to, depending on their location within the metropolitan area. The flat strip between the Atlantic Ocean and the Serra do Mar is crossed by a large number of water streams and swamps. Due to the intense and unplanned urbanization in the area, translated into low levels of sanitation services, water quality represents an important concern for the residents. This is aggravated by the intense rainfall throughout the year, causing sewer spillovers and clogging of storm drains in some parts of the municipalities.

Figure 2: Baixada Santista Metropolitan Area



Analytical Samples and Variables

We estimated two separate GoM models, one for each metropolitan area of the state of São Paulo: Campinas Metropolitan Area and Baixada Santista Metropolitan Area. The sample for CMA includes 1,806 households (17 households were excluded due to missing information on selected variables). The sample for the BSMA includes 1,586 households (10 households were excluded due to missing info). For each model we use 29 variables, including 3 variables for socioeconomic status and 7 variables for household and neighborhood environment. Further detail about variables used, see Table 1.

Empirical Strategy

In order to create multidimensional profiles of environmental perception and behavior, we selected a wide range of variables representing environmental knowledge, concern and behavior at the household level and applied them to the Grade of Membership (GoM) model (Manton et al., 1994). The simultaneous use of these sets of variables helps us to explore non-linear relationships between what is perceived, how perception correlates with behavior and how these relations vary by level of spatial reference. One example of these complex associations is the concept of *environmental projection*. That is, agents tend to see their immediate, local environmental problems as the main environmental issues faced by the country as a whole. At the same time, groups with high levels of environmental concern may engage in different levels of environmentally significant behaviors. In general, these differences are mainly explained by two factors: (1) socioeconomic status, which may

works as a facilitator or a constraint for a household to take pro-environmental actions, and (2) the ability to overcome budget constraints by engaging in low-cost environmental behaviors, such as collection action (Dunlap and York, 2008).

The use of GoM allows us to explore these different patterns of associations across environmental and socio-residential dimensions by producing reference groups of environmental behavior and perception, as well as the intensity that each reference group manifests in each individual. Because the method is based on fuzzy logic, individuals are not assumed to belong to any specific reference group (Manton et al., 1994). The individual membership to different reference groups is explicitly estimated by the model and can be interpreted as a *continuous measure* of individual heterogeneity derived from a *discrete* set of indicators. The “degree of membership” parameter, the truly fuzzy parameter of the model, can be used for different purposes: (1) to weight the estimated probabilities of patterns of answers in each reference groups, creating fuzzy-weighted multidimensional profiles, (2) to estimate the multidimensional prevalence of each reference group in a population, and (3) to study regression relationships.

The difference between fuzzy-weighted and crisp reference groups resides on the fact that the latter does not take into account how each individual in a population may manifest profile characteristics at different levels of intensity. By imposing an assignment function to force individuals to belong to one of the profiles, all the heterogeneity is collapsed into a binary pertinence function. The fuzzy-weighted profiles, on the other hand, explicitly use this fuzzy pertinence as weights to create and describe the characteristics of the reference groups. This way, final profiles are a closer representation of how individuals are actually distributed in a specific population (Manton et al., 1994). The multidimensional prevalence using the fuzzy parameter has the same advantage of using it as a weighting factor. Different from crisp prevalence, the fuzzy weighted prevalence must be interpreted as the proportion of the population that has *at least some* manifestation of the reference group.

To estimate the multidimensional profiles, we included 29 variables classified in four dimensions:

- a) Environmental perception
- b) Behavioral response to environmental problems (intended behavior + actions)
- c) Socioeconomic status
- d) Residential and neighborhood environment

The detailed wording of variables is described in Table 1.

Table 1: Internal Variables Used in the Delineation of the Multidimensional Environmental Profiles – Campinas and Baixada Santista Metropolitan Areas, 2007

Environmental Perception

- In your opinion, what is the main problem in regards to the environment in Brazil?
- In your opinion, what is the main problem with the environment in your neighborhood?
- In your opinion, how serious is global warming?
- In your opinion, who should/could solve the problem of global warming?
- In your opinion, who should/could solve the environment problems you mentioned before?

Intended Environmental Behavior

- Would you consider separating garbage or trash for recycling?
- Would you consider eliminating unnecessary waste of water?
- Would you consider reducing gas and energy consumption?
- Would you consider working collective with others?
- Would you consider taking collective action against a company that pollutes the environment?
- Would you consider contributing to environmental organizations?
- Would you consider paying more for foods without chemical fertilizers?
- Would you consider buying more energy efficient household appliances?

Actual Environmental Behavior

- In the past 12 months, have you avoided throwing toxic products in the trash?
- In the past 12 months, have you avoided buying a product because of information on the label?
- In the past 12 months, have you fixed a broken product in order to avoid buying a new one?
- In the past 12 months, have you decreased the consumption of meat?
- In the past 12 months, have you stopped buying a product because it harmed the environment?

Residential and Neighborhood Environment

- Current municipality of residence
- Conditions of the street surface
- Does the street have curb and gutter?
- Does the street have sidewalks?
- Does the street have public lighting?
- Frequency of the water supply
- Type of sewage drain
- Frequency of garbage and trash collection

Socioeconomic Status of the Household

- Schooling of respondent
- Deciles of per capita household income
- Social strata of the household

Source: Data from Projeto Vulnerabilidade (NEPO/Unicamp)

Using the variables listed in Table 1 for each study site, we started estimating models with different numbers of extreme profiles, from 2 to 6, holding constant the number of variables and observations. The selection of number of clusters (profiles) that best describe that data used was based on the Akaike Information Criterion (AIC). AIC is a largely used measure of goodness of fit and different from the likelihood ratio test, it includes the number of parameters in addition to the final likelihood value to find the best model. The smaller the AIC value the better the model (Manton et al., 1994). We estimate AIC using the following formula:

$$AIC = 2p - 2\ln(L)$$

Table 2 suggests that the model that best describe the data used, for both study sites, is a model with 4 extreme profiles.

Table 2: Selection of Optimal Number of Extreme Profiles for Campinas and Baixada Santista Samples

# of Extreme Profiles (K)	I	L	P	ln(L)	AIC
<i>Campinas Metropolitan Area</i>					
2	1806	118	3848	-41683	91.062
3	1806	118	5772	-34981,6	81.507
4	1806	118	7696	-32450,9	80.294
5	1806	118	9620	-31005,1	81.25
6	1806	118	11544	-30433,5	83.955
<i>Baixada Santista Metropolitan Area</i>					
2	1586	116	3404	-35442,7	77.693
3	1586	116	5106	-32742,2	75.696
4	1586	116	6808	-29659,4	72.935
5	1586	116	8510	-28218,2	73.456
6	1586	116	10212	-27793,8	76.012

Source: Data from Projeto Vulnerabilidade (NEPO/Unicamp)

The characterization of the extreme profiles was based on the estimated fuzzy-weighted conditional probabilities of response to category l of variable j in the extreme profile k , y_{ijl} . The estimated probabilities correspond to the product of the degree of membership (g_{ik}) and the crisp probabilities (λ_{kjl}) for the reference groups:

$$E(y_{ijl}) = \sum_k (g_{ik} * \lambda_{kjl})$$

As the above formula suggests, g_{ik} and λ_{kjl} are estimated at different levels, the former at the individual while the latter at the category level. We use the value $I_k^{-1}(g_{ik})$ to represent the average value of membership for each K. To preserve the number of K identified with the AIC measure, we use the relative mode of g_{ik} over K to weight each profile. Each estimated probability was then divided by the marginal frequency observed in the population. This ratio, called E/O Ratio, is used to select the categories of each variable that predominates in each extreme profile, k . Following the cut point suggested by Sawyer et al. (2002), we define a category l , of a variable j , to be the marker of that profile every time $E/O \text{ Ratio} \geq 1.2$. This means that the probability that a household, belonging to a fuzzy-weighted extreme profile k , answers category l of variable j , is at least 20% higher than the probability of answer for the same category given by an average household in the entire population (see Tables A and B for the original estimated probabilities).

In addition to creating profiles of environmental perception, we also estimate the fuzzy-weighted prevalence of each one of these profiles in the entire population, as follows:

$$P_k = \frac{\sum_{i=1}^I g_{ik}}{I}$$

where g_{ik} represents the degree of membership of individual i to extreme profile k . I represents the number of observations in the sample (Cassady et al., 2001). Multidimensional prevalence of environmental perception is a simple and straightforward way to access current social knowledge about environmental issues among households in a given setting.

Finally, to explore the correlation between vulnerability, social strata and environmental awareness using regression analysis, we created a scalar of environmental vulnerability. The scalar was estimated by using four-point Likert-type questions about potential problems affecting the surrounding areas of the house, varying from very serious to not serious at all. We use the following potential problems: (1) contaminated areas, (2) accessibility to other neighborhoods, (3) flooding, (4) torrents/runoffs, (5) landslides, (6) difficulty to get to the workplace, (7) lack of leisure/entertainment areas in the surroundings, (8) accessibility to the nearest school, (9) heavy traffic, (10) difficult access to the nearest health post, (11) lack of green spaces, (12) problems with water system provision and collection, (13) problems with garbage collection, (14) insects, rats, ticks, crane-flies, (15) weeds, abandoned lots, and (16) problems with the sewage system. To create the scalar, we applied a fixed matrix of λ_{kjl} within GoM, attributing $\lambda_{2jl}=1.000$ to the categories “not serious at all” and $\lambda_{1jl}=1.000$ to the categories “very serious” over the 16 questions. With this procedure, the fuzzy partition g_{i2} can be interpreted as the inverse of environmental vulnerability of the households. The scalar created show high level of reliability, with standardized Cronbach’s alpha of 0.8848 for CMA and 0.8743 for BSMA. The scalar was then regressed on a dummy variable indicating unawareness about global warming. More details in the result section.

Results

For the multidimensional profiles we present the results in text and graph format, although detailed results about the probabilities can be found in the appendix section (Tables A and B). Some head-ups: (1) the results presented in the graphs are *relative probabilities*, that is, how much higher (lower) are the probabilities of response for specific categories in each profile relative to the average probability in the sample population; (2) the names attributed to the profiles represent a generalization of salient characteristics of each profile; (3) the ideal types created do not necessarily exist in the sample population, but we can estimate the probability of belonging to these ideal types for each multidimensional profile. Results are presented for each metropolitan area separately.

Campinas Metropolitan Area

We could classify the respondents from CMA in four main multidimensional environmental profiles: (1) “Self-interested Environmental Behavior”, (2) “Environmentally Significant Behavioral Gap”, (3) “Environmentally Engaged”, and (4) “Environmentally Unengaged”.

The “Self-interested Environmental Behavior” profile comprises 36.5% of the CMA residents – the most prevalent profile in the sample. Individuals from this profile reside in the municipalities of Americana, Monte-Mór, Nova Odessa, Paulínia, Santa Barbara D’Oeste, and Valinhos. They live in neighborhoods with high levels of public services and infrastructure, such as paved streets with curb and gutter, general sewage system and continuous garbage collection. They show high level of environmental knowledge, such as considering global warming as a very serious problem and differentiating their local from national environmental issues. Although recognize the importance of individual participation in fighting environmental problems at both local and national levels, their behavior reflects actions that provide a direct increase in their utility, such as elimination of waste of water and reduction of gas/energy consumption. This behavior pattern is consistent with their intentions, since they are more willing to fix products to avoid buying new ones, although are less like to engage in collective actions than the average sample population. These are predominantly middle-class households, with average household income, although respondents have low educational status.

The “Environmentally Significant Behavioral Gap” profile clusters 23.6% of CMA residents, being the second most prevalent. Individuals from this profile reside in Americana, Cosmopolis, Itatiba, Pedreira, and Sumaré, in areas with high levels of public services and infrastructure, as in the previous profile. Different from the previous profile, however, they show lower levels of environmental knowledge; e.g., they don’t think global warming is a serious problem and some respondents think neither their neighborhoods nor the country have any environmental issue to be worried about. Among the ones who consider any problem at the national level, deforestation stands out as the most important, and pollution of river, lakes, and beaches as the main local environmental issue. They also tend to transfer responsibility to fight environmental problems to institutions, such as the federal government and international organizations. These are predominantly from middle-class households, with respondents having from 5 to 11 years of education completed.

The “Environmentally Engaged” profile groups 22.7% of CMA residents, ranking as the second less prevalent. Individuals from this profile reside in Campinas and Indaiatuba, located in neighborhoods with deficient infrastructure, such as paved streets with pot holes and lack of public lighting in some streets, although are served with good levels of public services, such as garbage collection and general sewage system⁴. Members of this group show high levels of environmental knowledge, by both recognizing global warming as a very serious problem and differentiating local from national environmental issues, identifying deforestation, lack of green spaces, and pollution of rivers as the main local issues while environmental sanitation, air pollution and fire as the major national problems. Similar to the first profile, they consider that both individuals and non-governmental

⁴ This apparent contradictory correlation between high SES and low levels of urban infrastructure is not surprising in Campinas, the metropolitan seat, since the most affluent neighborhoods are now located in older settlement areas. It is not rare to find better public infrastructure, mainly newly paved streets and roads, in the new and less affluent neighborhoods as a result of recent urbanization of the suburbs.

organizations should be the main actors of environmental change. Usually show alignment in their actual and intended pro-environmental behavior, reporting high levels of participation in both private (individual) and public (collective) behavior to improve the quality of the environment. These are more affluent households, clustering respondents with higher levels of education.

The “Environmental Unengaged” profile clusters 17.3% of CMA residents - last prevalent profile in the metropolitan area. Individuals from this profile reside in Artur Nogueira, Hortolândia, and Indaiatuba, living in neighborhoods with very low levels of both public services and infrastructure. They are characterized by very low levels of environmental knowledge, as they ignore global warming as an environmental problem and project their immediate/local environmental issues as national issues. For instance, they see environmental sanitation and floods as the main environmental problems of Brazil, although these also appear as local problems, consistent with the vulnerable residential areas where their households are located. Maybe because of their vulnerable condition, they attribute problem solving at both scales (local and national) to local/state level government, adding additional evidence of environmental projection. This pattern of environmental knowledge and perception of environmental issues reflect in their unengagement in pro-environmental behaviors, both actual and intended. These are illiterate respondents from low-income households.

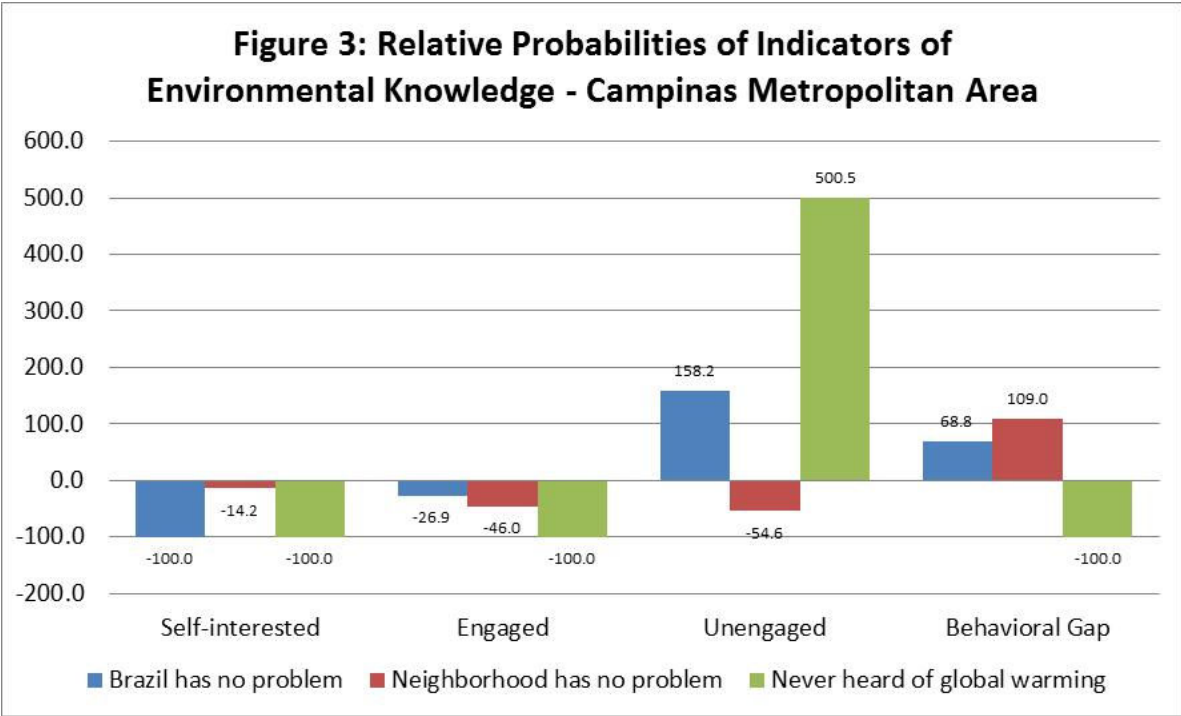


Figure 3 shows that the level of environmental knowledge is higher among the environmentally engaged and self-interested profiles, while lower among the other two, especially in the environmentally unengaged profile. When we look at the awareness about local environmental problems, however, the environmentally unengaged profile are the

most likely to be report at least one problem, what may reflect their more vulnerable social and environmental position in the population.

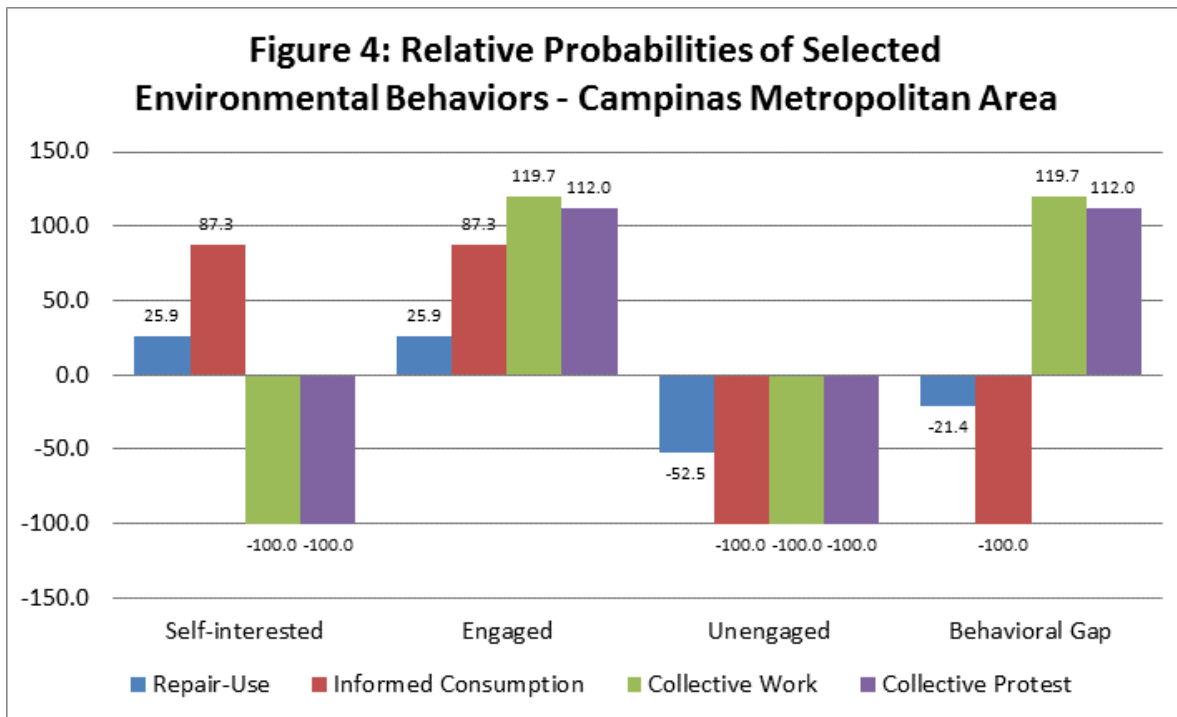


Figure 4 presents the behavioral patterns of selected variables across profiles. We selected two private (individual) and two public (collective) environmental behavioral indicators to explore differences in behavioral response according to its nature. Repair-use and informed consumption are representative of private behavior, referring to actual actions taken by the respondent in the last 12 months (repair-use = fixed a product to avoid buying a new one; informed consumption = interrupted consumption because of information on the label). Collective work and protest, on the other hand, represent public intended behavior. As expected, the “engaged” and “unengaged” profiles have flipped relative probabilities for all pro-environmental behaviors. In addition, members of the “self-interested” profile are more likely than the average population to engage in private behaviors, but not in publics. Although not entirely shown in Figure 4, members of the “behavioral gap” profile have higher probabilities of being willing to take pro-environmental actions, although their actual behavior does not reflect that. They are actually less likely than the average population to have actually engaged in any significant environmental behavior in the last 12 months, regardless of the private/public nature of the actions.

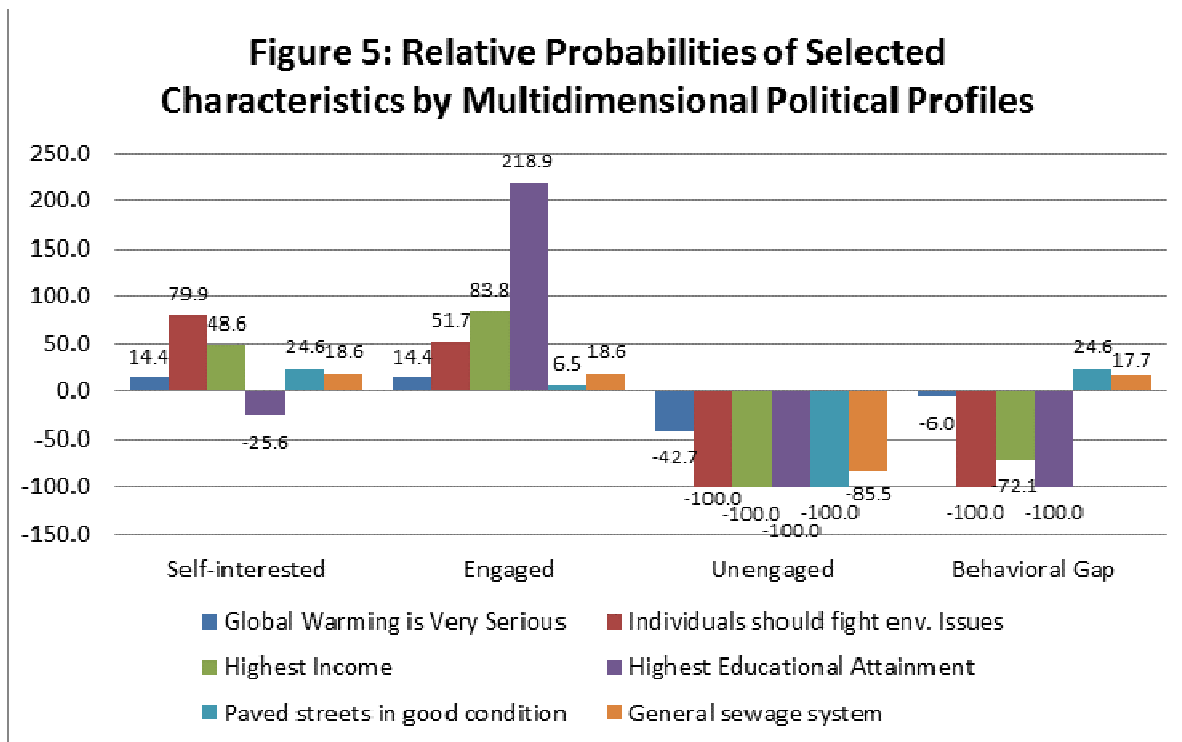


Figure 5 suggest that among residents of CMA, engagement is correlated to a certain minimum level of socioeconomic status, although environmental knowledge and behavior are not strictly selective of SES, since individuals of similar socioeconomic status and educational background have different levels of knowledge about environmental issues and may engage in different behavioral patterns, as suggested by the probabilities of responding that global warming is a very serious problem among members of “unengaged” and “behavioral gap” profiles. This complex correlation structure between environmental knowledge and behavior along with SES can be seen looking at the two most prevalent profiles in CMA, both from similar SES but with very different behavioral responses.

Baixada Santista Metropolitan Area

Similarly to CMA, we found four multidimensional environmental profiles in BSMA: (1) “Self-interested Environmental Behavior”, (2) “Environmentally Engaged”, (3) “Environmentally Unengaged”, and (4) “Collective Environmental Behavior”.

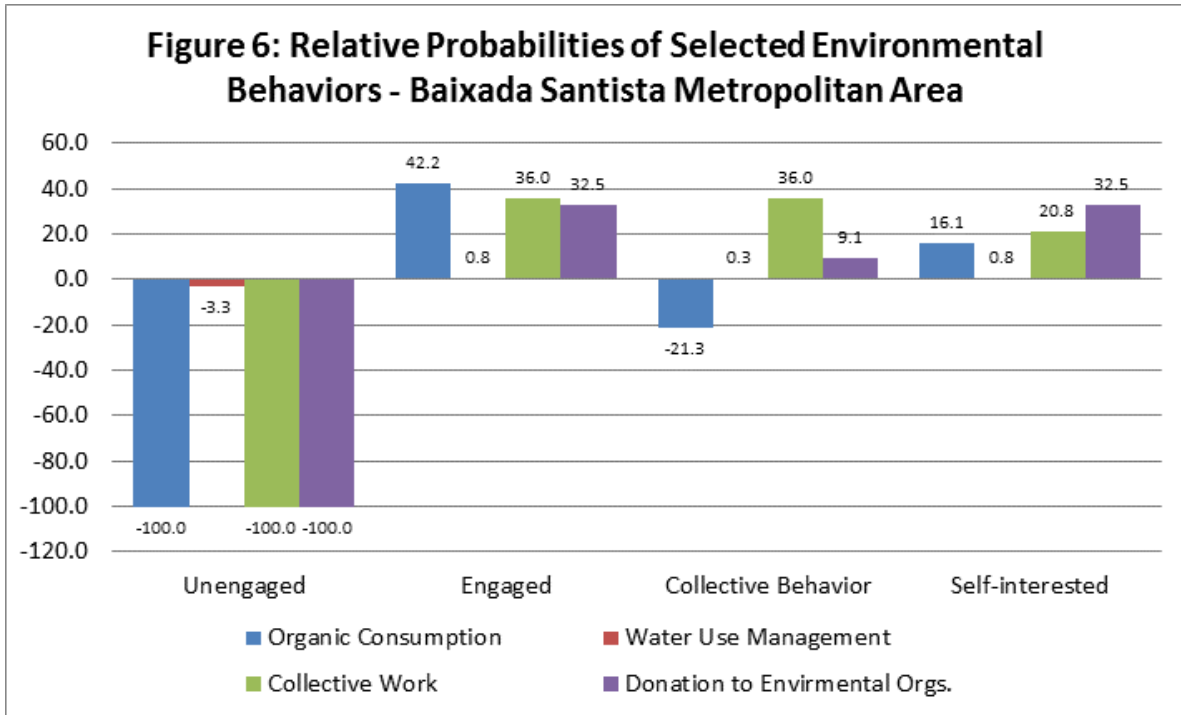
The “Self-interested Environmental Behavior” is the most prevalent, comprising 35.5% of the BSMA residents. Individuals from this profile live in Santos, the metropolitan seat, in neighborhoods with high levels of public services and infrastructure. They differentiate local from national problems, although project air pollution, a largely recognized problem in the metropolitan seat, as an environmental natural issue. Environmental knowledge is high, with individuals recognizing global warming as a very serious problem. Different from the homonymous profile from CMA, however, problem-solving is attributed to institutions at higher levels of influence, such as international organizations and world leaders, although some also recognize individual responsibility in fighting the

environmental issues identified. As for CMA, their behavior is self-oriented, taking actions that directly increase individual utility, such as consumption of organic produce, but not reducing energy and water consumption. In addition, they show willingness to engage in socially desirable behaviors, such as contributing with donations to environmental organizations. These are more affluent households, with highly educated respondents.

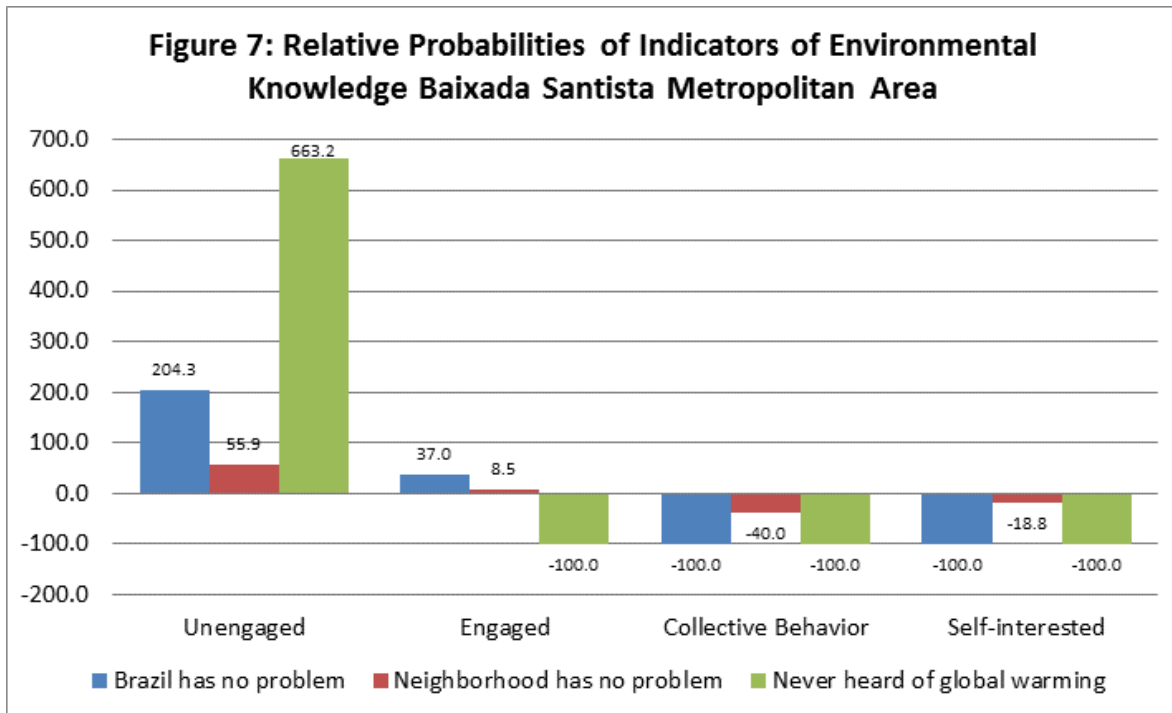
The “Environmentally Engaged” profile is the second most prevalent, with 30.8% of BSMA residents. Members of this profile live in the municipalities of Guarujá, Itanhaém, Mongaguá, Praia Grande and São Vicente, in neighborhoods with deficient provision of certain public services, such as water provision and garbage collection discontinuously served. Different from its homonymous profile from CMA, they show low levels of environmental knowledge, by not considering global warming as a serious problem and projecting local problems to the national level, such as pollution of rivers, lakes and beaches, as well as lack of green spaces and flooding. Despite their low level of environmental knowledge, they still recognize that environmental problem-solving must be a joint effort of individuals and institutions. This recognition of the self in the process of environmental change translates into engagement in pro-environmental behavior. These are individuals from middle-class households, but respondents have low level of education (1 to 4 years of education completed).

The “Environmentally Unengaged” profile is the second less prevalent, with 18% of BSMA residents. Its members live in Cubatão, Peruíbe, and São Vicente, in neighborhoods with deficient public infrastructure, such as discontinuous garbage collection, septic tank instead of general sewage system and streets with pot holes. As with its homonymous profile from CMA, individuals from this profile show very low levels of environmental knowledge, such as believing both Brazil and their neighborhoods have no environmental problems. Because of lack of recognition of environmental problems, they hold public institutions responsible for eventual environmental issues and show no engagement in any of the environmental behaviors listed in Table 1. These are socioeconomic disadvantaged households, with respondents having very low levels of education (mainly illiterates or up to 4 years of education completed).

The “Collective Environmental Behavior” profile is the least prevalent, comprising 15.8% of BSMA residents. Its members live in Bertioga, Cubatão, Guarujá and Itanhaém, in neighborhoods with deficient public services and infrastructure. As with the previous profile, they project their local problems into the national level, such as environmental sanitation (in the beach cities) and deforestation (mainly in Cubatão). Consider global warming a very serious problem and hold institutions responsible for problem-solving. In terms of behavior, they consider taking environmental significant actions for non-luxury goods, such as acting collectively to reduce individual cost of action, but avoiding high-cost actions, such as recycling and consumption of organic food. These are households from low social strata, with individuals having low level of education.



Again, similarly to what we found across CMA profiles, the “Unengaged” and “Engaged” profiles show flipped patterns of relative probabilities. While individuals from the “Environmentally Unengaged” profile have an overall general probability of engaging in pro-environmental actions, the opposite holds for individuals from the “Environmentally Engaged” profile. Among individuals from the “Collective Environmental Behavior” profile public actions are more likely than private actions. For instance, they are more likely to accept working collective with others, while less like to buy organic produce than the average population. Although they are also more likely to contribute to environmental organizations, as the “Engaged” and “Self-interest” groups, the likelihood is much lower. This is explained by their lower socioeconomic status. In addition, the question is not clear about what kind of contribution the person would be willing to provide; thus, they may be interpreting it as donation of time instead of money. Finally, the “Self-interested Environmental Behavior” profile show the smallest probability, among the profiles of being willing to engage in collective work, as expected.



If we turn our attention to indicators of environmental knowledge, we generally see that the “Unengaged” profile has a much higher probability than the average population to be unaware of environmental issues in the country and the neighborhood, as well as global warming. This pattern is reversed by the others, except for the “Engaged” groups (Figure 7). This graph reveals two interesting points: (1) the level of environmental knowledge is sensitive to the spatial reference; (2) socioeconomic background is not a pre-requisite of environmental knowledge. The first point can be illustrated by looking at how the likelihood of being unaware of environmental issues decrease among individuals in the “unengaged” profile as we move from general questions (such as global warming) to local questions (such as problems in the neighborhood). The second point becomes clear when we compare the predicted probabilities between the “Unengaged” and “Collective Behavior” profiles. Individuals from these two profiles belong to socioeconomic disadvantaged households, although the individuals from the latter are as likely as the “Self-interested” members to be aware of environmental problems across all spatial scales (global, national and local).

Figure 8: Relative Probabilities of Selected Characteristics by Multidimensional Political Profiles

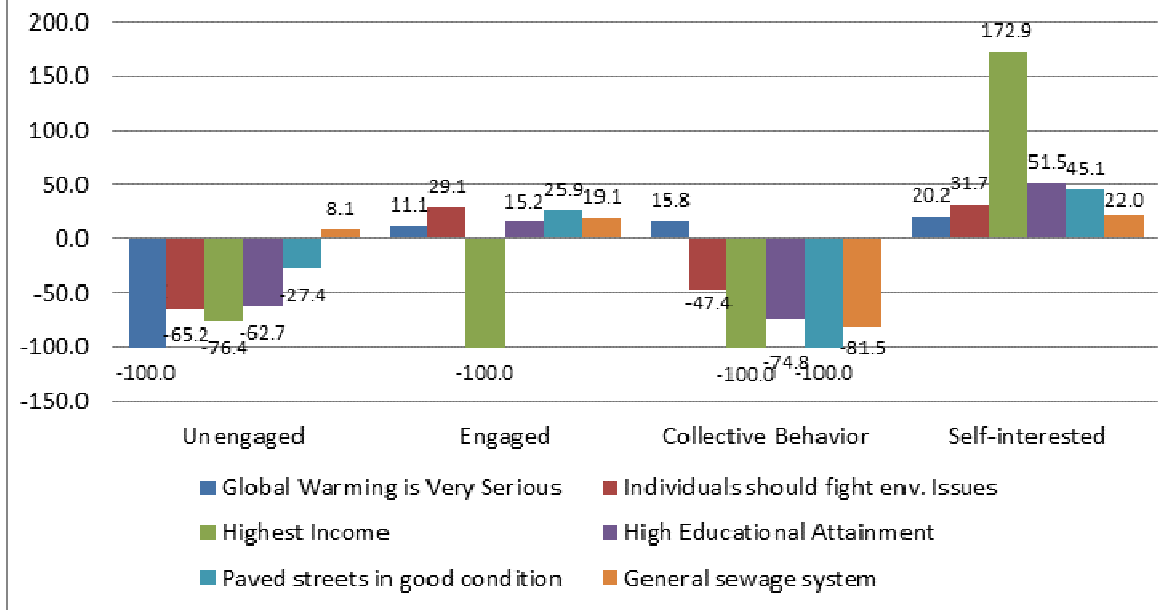


Figure 8 helps us to further explore these non-linear relations between SES, perception, knowledge and behavior. We see, in general, that both groups, “Unengaged” and “Collective Behavior” have a lower probability to belong to socioeconomic affluent households than the other profiles, although they show different levels of environmental knowledge. For instance, while the members of the “Environmentally Unengaged” profile have 100% lower likelihood to recognize global warming as a very serious environmental issue, members of the “Collective Environmental Behavior” profile are 15.8% more likely to do so. Combined with information from Figure 7, comparison between these two profiles also suggest that even with similar SES background, some groups are more likely than others to engage in pro-environmental action, finding alternative ways to reduce the cost of action by pursuing collective initiatives that help fight environmental problems. Again, as suggested by Figure 5 among residents of CMA, socioeconomic status is not a pre-requisite for environmental awareness or pro-environmental behavior.

Environmentalism and Environmental Vulnerability

Results from profile descriptions and predicted probabilities of pertinence to ideal types suggest that socioeconomic status and household physical characteristics are not a pre-requisite for environmentalism. Inglenhart’s hypothesis of environmentalism of the poor, however, suggests that individuals in low-income settings increase their environmental concern as a response to objective problems. When environmental threats are ceased, concern should decline or disappear. From the previous analysis we cannot say if

vulnerability to environmental hazards is an underlying cause of this association between socioeconomic status and environmentalism among less affluent households.

According to Inglehart’s “objective problems” hypothesis, we should see a positive correlation between environmental vulnerability and high levels of environmental concern/knowledge among socioeconomically disadvantaged households. Similarly, the “post-materialistic values” hypothesis predicts high levels of environmental concern/knowledge among more affluent households, *regardless of* their level of environmental vulnerability. Figure 9 and 10 show relative probabilities of living in households with different levels of environmental vulnerability across profiles. As suggested by Figure 9, residents of low SES households in CMA with high levels of environmental hazards are the less likely to be aware of or concerned with environmental problems, as revealed by the probabilities of the “Environmentally Unengaged” profile. Figure 10 suggest mixing results. On the one hand, individuals from the “Collective Behavior” profile show high level of environmental awareness, being also poor and living in households with high levels of environmental vulnerability, in tandem with the “objective problems” argument. At the same time, profiles with similar levels of vulnerability show different levels of engagement, such as the profiles “Environmentally Unengaged” and “Environmentally Engaged”.

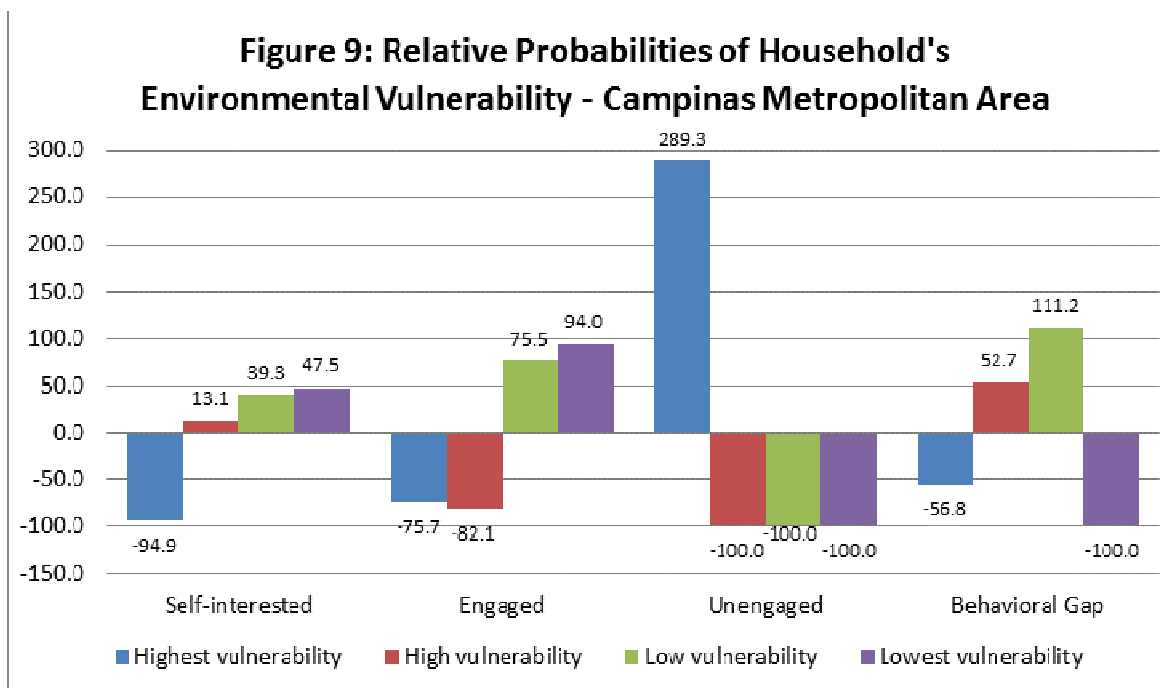
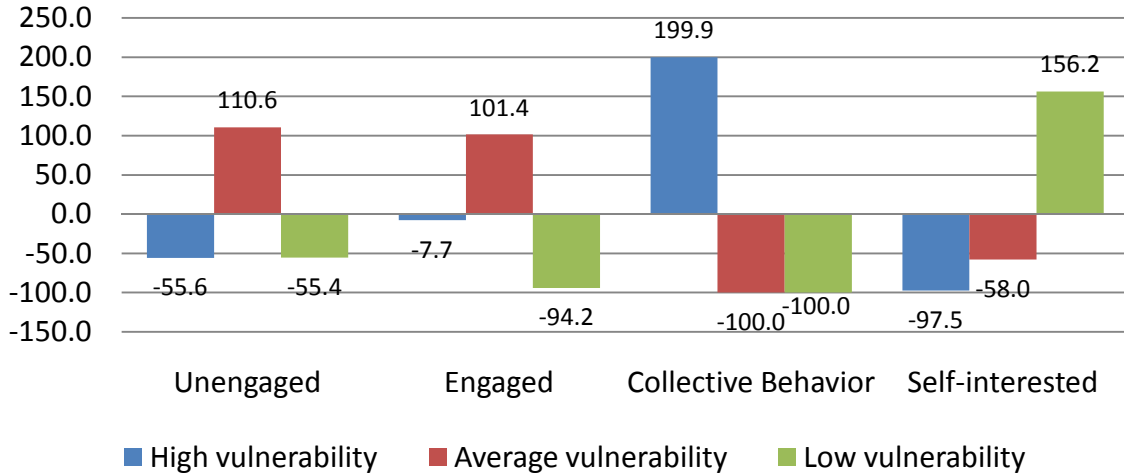
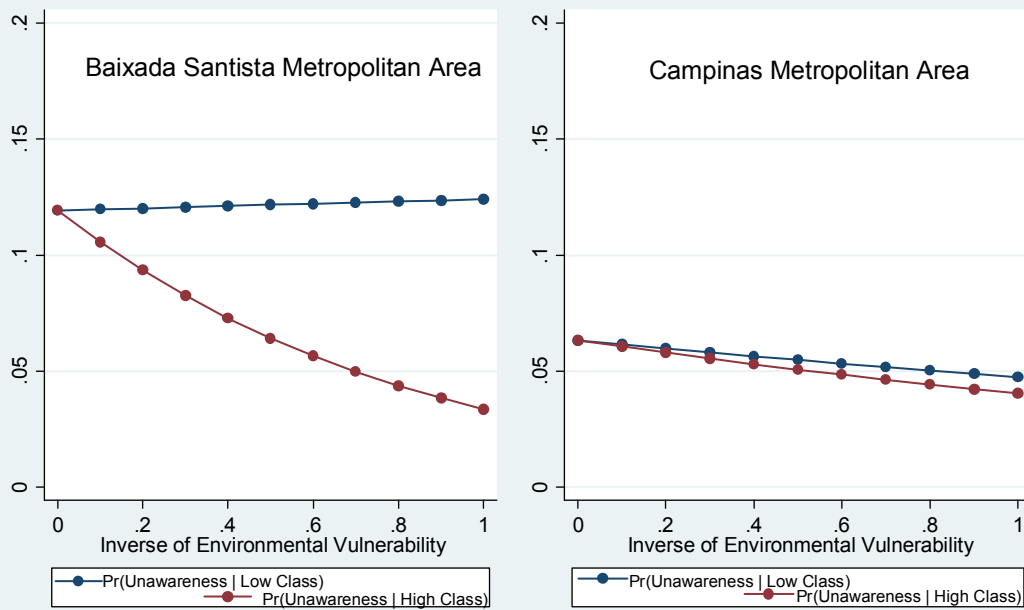


Figure 10: Relative Probabilities of Household's Environmental Vulnerability - Baixada Santista Metropolitan Area



Motivated by the findings from Figures 9 and 10, we regressed the vulnerability scale on a proxy for knowledge about global warming (dummy). The logit model uses the environmental vulnerability scalar along with an interactive term of the scalar with a dummy for household from low social stratum. The model includes other control variables, such as age, education, time living in the city and education of respondent (see Table C for regression results). Figure 11 shows the predicted probability of being unaware of the existence of global warming according to the level of environmental vulnerability a household is exposed to. The probabilities take into consideration the interactive effect of social strata on environmental knowledge. Results, again, do not support Inglehart's argument about vulnerable households showing concern about the environment because they are the more likely to be threatened by environmental hazards. Actually, the figure suggests that more affluent households' awareness declines at a faster pace than less affluent households when environmental vulnerability increases. This holds for both study area.

Figure 11: Predicted Probability of Unawareness about Global Warming by Level of Environmental Vulnerability



Source: Projeto Vulnerabilidade (NEPO/Unicamp)

Concluding Remarks

In recent decades the increase in extreme events along with scientific evidence of the anthropogenic effect on environmental change has put environmental questions in the core of public agenda worldwide. During the 1980's and 1990's, many surveys about environmental concern, behavior, and attitude were conducted in developed countries to understand how people perceive changes in the environment, what is their current knowledge, and how they solve tradeoffs between conservation of nature and economic development. Fewer efforts were done to analyze patterns of environmentalism in developing settings until very recently.

Cross-national studies suggested that individuals from developed countries show a higher level of environmental concern than their counterparts from low-income settings, giving birth to the “post-materialist values versus objective problems” hypotheses (Inglehart, 1995). Although the Inglehart's argument recognizes the existence of environmentalism among the poor in face of objective environmental threats, it suggests that environmental concern and awareness should cease when problems were solved or immediate threats were not felt or perceived. Our results suggest that although residents of more affluent and less vulnerable areas have high levels of environmental knowledge and engage in pro-environmental behaviors, as expected, some less affluent households engage in environmental significant behavior through collective actions. We believe that the use of

collective action as a channel to express environmental concern may represent a way to reduce the cost of actions. In addition, we found households with similar levels of vulnerability to environmental hazards with different levels of awareness and engagement in pro-environmental behaviors. Similar trends have been supported by empirical studies in low-income settings worldwide (Chen et al., 2011; White and Hunter, 2009).

Although our results suggest some level of environmentalism among the poor, socioeconomic inequalities still plays a key role in explaining variation in the level of perception and behavior. We found that, for both study areas, a minimum level of socioeconomic level is necessary to trigger pro-environmental engagement. These complex relations between awareness, behavior, vulnerability and affluence is a likely combination of different forces: (1) extreme events are more common and frequent, exposing individuals of different social backgrounds to similar levels of vulnerability; (2) because of this, and due to increasing scientific evidence of anthropogenic change in the environment, public discussion of environmental change has become more salient for the general population, and (3) some slow changes in the quality of the environment due to the current model of industrial development are just now being felt by the general population. Increasing awareness is one first step, motivating individuals to engage in pro-environmental behavior the second, but transforming micro-scale actions into empowered social groups able to influence decisions about sustainable development is the ultimate cause studies about environmental change should focus.

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Annex

Table A - Descriptive Statistics for Selected Variables, Estimated Probabilities of Response and Ratio E/O of Multidimensional Environmental Profiles - Campinas Metropolitan Region, 2007 (continues)

<i>Residential and neighborhood environment</i>	Absolute Frequency	Observed Probability	Profile 1 λ_{1ji} (Ratio E/O)	Profile 2 λ_{2ji} (Ratio E/O)	Profile 3 λ_{3ji} (Ratio E/O)	Profile 4 λ_{4ji} (Ratio E/O)
1 - Current municipality of residence						
Americana	152	0.084	0.121 (1.4)	0.000 (0.0)	0.000 (0.0)	0.176 (2.1)
Artur Nogueira	13	0.007	0.000 (0.0)	0.000 (0.0)	0.041 (5.7)	0.000 (0.0)
Campinas	1035	0.573	0.531 (0.9)	0.884 (1.5)	0.535 (0.9)	0.396 (0.7)
Cosmopolis	25	0.014	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.059 (4.3)
Hortolandia	134	0.074	0.000 (0.0)	0.000 (0.0)	0.373 (5.0)	0.000 (0.0)
Indaiatuba	52	0.029	0.000 (0.0)	0.087 (3.0)	0.052 (1.8)	0.000 (0.0)
Itatiba	59	0.033	0.031 (0.9)	0.029 (0.9)	0.000 (0.0)	0.063 (1.9)
Monte Mor	14	0.008	0.021 (2.7)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Nova Odessa	28	0.016	0.043 (2.8)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Paulinia	13	0.007	0.020 (2.8)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Pedreira	14	0.008	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.033 (4.3)
Barbara D'Oeste	74	0.041	0.116 (2.8)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Sumare	152	0.084	0.053 (0.6)	0.000 (0.0)	0.000 (0.0)	0.274 (3.3)
Valinhos	41	0.023	0.063 (2.8)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
2 - Conditions of the street surface						
Paved in good condition	1450	0.803	1.000 (1.2)	0.855 (1.1)	0.000 (0.0)	1.000 (1.2)
Paved with pot holes	59	0.033	0.000 (0.0)	0.145 (4.4)	0.000 (0.0)	0.000 (0.0)
Not paved - regular surface	170	0.094	0.000 (0.0)	0.000 (0.0)	0.575 (6.1)	0.000 (0.0)
Not paved - irregular surface	127	0.070	0.000 (0.0)	0.000 (0.0)	0.425 (6.0)	0.000 (0.0)
3 - Does the street have curb and gutter?						
No	297	0.164	0.000 (0.0)	0.000 (0.0)	1.000 (6.1)	0.000 (0.0)
Yes	1509	0.836	1.000 (1.2)	1.000 (1.2)	0.000 (0.0)	1.000 (1.2)
4 - Does the street have sidewalks?						
No	275	0.152	0.000 (0.0)	0.000 (0.0)	1.000 (6.6)	0.000 (0.0)
Yes	1531	0.848	1.000 (1.2)	1.000 (1.2)	0.000 (0.0)	1.000 (1.2)
5 - Does the street have public lighting?						
No	17	0.009	0.000 (0.0)	0.012 (1.3)	0.039 (4.1)	0.000 (0.0)
Yes	1789	0.991	1.000 (1.0)	0.989 (1.0)	0.961 (1.0)	1.000 (1.0)
6 - What's the frequency of the water supply?						
Continuous - the whole day	1600	0.886	0.897 (1.0)	0.992 (1.1)	0.815 (0.9)	0.818 (0.9)
Some hours per day	119	0.066	0.103 (1.6)	0.000 (0.0)	0.078 (1.2)	0.063 (1.0)
Discontinuous	60	0.033	0.000 (0.0)	0.000 (0.0)	0.031 (0.9)	0.119 (3.6)
Missing	27	0.015	0.000 (0.0)	0.008 (0.5)	0.076 (5.1)	0.000 (0.0)
7 - Type of sewage drain						
General sewage system	1523	0.843	1.000 (1.2)	1.000 (1.2)	0.123 (0.1)	0.992 (1.2)
Septic tank	224	0.124	0.000 (0.0)	0.000 (0.0)	0.701 (5.7)	0.000 (0.0)
Simple cesspools	28	0.016	0.000 (0.0)	0.000 (0.0)	0.078 (5.0)	0.008 (0.5)
Throw into rivers / missing	31	0.017	0.000 (0.0)	0.000 (0.0)	0.098 (5.7)	0.000 (0.0)
8 - Frequency of garbage and trash collection						
Discontinuous	1179	0.653	0.493 (0.8)	0.294 (0.5)	0.983 (1.5)	1.000 (1.5)
Daily	602	0.333	0.495 (1.5)	0.676 (2.0)	0.000 (0.0)	0.000 (0.0)
Missing	25	0.014	0.012 (0.9)	0.029 (2.1)	0.017 (1.2)	0.000 (0.0)

Source: Data from Projeto Vulnerability (NEPO/Unicamp)

Table A - Descriptive Statistics for Selected Variables, Estimated Probabilities of Response and Ratio E/O of Multidimensional Environmental Profiles - Campinas Metropolitan Region, 2007 (continues)

<i>Socioeconomic status of the household</i>	Absolute Frequency	Observed Probability	Profile 1 λ_{1ji} (Ratio E/O)	Profile 2 λ_{2ji} (Ratio E/O)	Profile 3 λ_{3ji} (Ratio E/O)	Profile 4 λ_{4ji} (Ratio E/O)
1 - Schooling of respondent						
Illiterate	144	0.080	0.072 (0.9)	0.000 (0.0)	0.261 (3.3)	0.036 (0.5)
1 to 4 years	542	0.300	0.376 (1.3)	0.103 (0.3)	0.450 (1.5)	0.262 (0.9)
5 to 8 years	473	0.262	0.228 (0.9)	0.145 (0.6)	0.289 (1.1)	0.403 (1.5)
9 to 11 years	446	0.247	0.241 (1.0)	0.397 (1.6)	0.000 (0.0)	0.299 (1.2)
12 years and more	201	0.111	0.083 (0.7)	0.355 (3.2)	0.000 (0.0)	0.000 (0.0)
2 - Deciles of per capita household income						
First	166	0.092	0.000 (0.0)	0.000 (0.0)	0.153 (1.7)	0.260 (2.8)
Second	155	0.086	0.033 (0.4)	0.000 (0.0)	0.228 (2.7)	0.127 (1.5)
Third	152	0.084	0.071 (0.8)	0.000 (0.0)	0.145 (1.7)	0.137 (1.6)
Forth	208	0.115	0.104 (0.9)	0.035 (0.3)	0.272 (2.4)	0.085 (0.7)
Fifth	157	0.087	0.128 (1.5)	0.045 (0.5)	0.105 (1.2)	0.060 (0.7)
Sixth	185	0.102	0.141 (1.4)	0.071 (0.7)	0.047 (0.5)	0.127 (1.2)
Seventh	209	0.116	0.175 (1.5)	0.086 (0.7)	0.051 (0.4)	0.122 (1.1)
Eighth	199	0.110	0.209 (1.9)	0.126 (1.1)	0.000 (0.0)	0.056 (0.5)
Ninth	170	0.094	0.140 (1.5)	0.173 (1.8)	0.000 (0.0)	0.026 (0.3)
Tenth	205	0.114	0.000 (0.0)	0.465 (4.1)	0.000 (0.0)	0.000 (0.0)
3 - Social class of the household						
Classes D and E	443	0.245	0.110 (0.4)	0.000 (0.0)	0.766 (3.1)	0.245 (1.0)
Class C	894	0.495	0.679 (1.4)	0.217 (0.4)	0.234 (0.5)	0.755 (1.5)
Class B	432	0.239	0.211 (0.9)	0.693 (2.9)	0.000 (0.0)	0.000 (0.0)
Class A	37	0.020	0.000 (0.0)	0.090 (4.4)	0.000 (0.0)	0.000 (0.0)

Source: Data from Projeto Vulnerability (NEPO/Unicamp)

Table A - Descriptive Statistics for Selected Variables, Estimated Probabilities of Response and Ratio E/O of Multidimensional Environmental Profiles - Campinas Metropolitan Region, 2007 (continues)

<i>Environmental perception</i>	Absolute Frequency	Observed Probability	Profile 1 λ_{1ji} (Ratio E/O)	Profile 2 λ_{2ji} (Ratio E/O)	Profile 3 λ_{3ji} (Ratio E/O)	Profile 4 λ_{4ji} (Ratio E/O)
1 - In your opinion, what is the main problem in regards to the environment in Brazil?						
Environmental sanitation	125	0.069	0.000 (0.0)	0.229 (3.3)	0.107 (1.5)	0.000 (0.0)
Pollution of rivers, lakes, beaches	393	0.218	0.349 (1.6)	0.175 (0.8)	0.132 (0.6)	0.111 (0.5)
Air pollution	283	0.157	0.165 (1.1)	0.363 (2.3)	0.096 (0.6)	0.000 (0.0)
Deforestation	685	0.379	0.404 (1.1)	0.000 (0.0)	0.263 (0.7)	0.775 (2.0)
Lack of green spaces	19	0.011	0.000 (0.0)	0.047 (4.5)	0.000 (0.0)	0.000 (0.0)
Floods	74	0.041	0.082 (2.0)	0.000 (0.0)	0.063 (1.5)	0.000 (0.0)
Fire	105	0.058	0.000 (0.0)	0.136 (2.3)	0.165 (2.8)	0.000 (0.0)
Other / No problems	122	0.068	0.000 (0.0)	0.049 (0.7)	0.174 (2.6)	0.114 (1.7)
2 - In your opinion, what is the main problem with the environment in your neighborhood?						
Environmental sanitation	311	0.172	0.000 (0.0)	0.129 (0.7)	0.685 (4.0)	0.099 (0.6)
Pollution of rivers, lakes, beaches	99	0.055	0.000 (0.0)	0.089 (1.6)	0.000 (0.0)	0.149 (2.7)
Air pollution	507	0.281	0.496 (1.8)	0.313 (1.1)	0.161 (0.6)	0.000 (0.0)
Deforestation	39	0.022	0.000 (0.0)	0.036 (1.7)	0.044 (2.0)	0.025 (1.2)
Lack of green spaces	61	0.034	0.000 (0.0)	0.153 (4.5)	0.000 (0.0)	0.000 (0.0)
Fire	347	0.192	0.294 (1.5)	0.148 (0.8)	0.000 (0.0)	0.216 (1.1)
Other / No problems	442	0.245	0.210 (0.9)	0.132 (0.5)	0.111 (0.5)	0.512 (2.1)
3 - In your opinion, how serious is global warming?						
Very serious	1579	0.874	1.000 (1.1)	1.000 (1.1)	0.501 (0.6)	0.822 (0.9)
Slightly serious	95	0.053	0.000 (0.0)	0.000 (0.0)	0.098 (1.9)	0.152 (2.9)
Not serious	16	0.009	0.000 (0.0)	0.000 (0.0)	0.015 (1.7)	0.026 (2.9)
Doesn't know about GW/Missing	116	0.064	0.000 (0.0)	0.000 (0.0)	0.386 (6.0)	0.000 (0.0)
4 - In your opinion, who should/could solve the problem of global warming?						
Each one of us	1026	0.568	0.995 (1.8)	0.854 (1.5)	0.000 (0.0)	0.023 (0.0)
Local government	67	0.037	0.000 (0.0)	0.000 (0.0)	0.226 (6.1)	0.000 (0.0)
State government	78	0.043	0.000 (0.0)	0.020 (0.5)	0.136 (3.1)	0.067 (1.6)
Federal government	285	0.158	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.658 (4.2)
International organizations	19	0.011	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.045 (4.3)
Ecological entities/organizations	14	0.008	0.005 (0.6)	0.014 (1.8)	0.009 (1.2)	0.005 (0.6)
World leaders	96	0.053	0.000 (0.0)	0.111 (2.1)	0.165 (3.1)	0.000 (0.0)
Entrepreneurs	15	0.008	0.000 (0.0)	0.000 (0.0)	0.009 (1.1)	0.029 (3.5)
Others	74	0.041	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.174 (4.2)
GW is not serious / never heard of	132	0.073	0.000 (0.0)	0.000 (0.0)	0.456 (6.2)	0.000 (0.0)
5 - In your opinion, who should/could solve the environmental problems indicated by the population?						
Each one of us	1004	0.556	1.000 (1.8)	0.843 (1.5)	0.000 (0.0)	0.000 (0.0)
Local government	101	0.056	0.000 (0.0)	0.004 (0.1)	0.334 (6.0)	0.000 (0.0)
State government	118	0.065	0.000 (0.0)	0.020 (0.3)	0.271 (4.1)	0.065 (1.0)
Federal government	374	0.207	0.000 (0.0)	0.000 (0.0)	0.179 (0.9)	0.731 (3.5)
International organizations	19	0.011	0.000 (0.0)	0.037 (3.5)	0.012 (1.1)	0.000 (0.0)
Ecological entities/organizations	16	0.009	0.000 (0.0)	0.039 (4.4)	0.000 (0.0)	0.000 (0.0)
World leaders	57	0.032	0.000 (0.0)	0.056 (1.8)	0.110 (3.5)	0.000 (0.0)
Entrepreneurs	15	0.008	0.000 (0.0)	0.000 (0.0)	0.017 (2.0)	0.022 (2.6)
Others	102	0.056	0.000 (0.0)	0.000 (0.0)	0.078 (1.4)	0.182 (3.2)

Source: Data from Projeto Vulnerability (NEPO/Unicamp)

Table A - Descriptive Statistics for Selected Variables, Estimated Probabilities of Response and Ratio E/O of Multidimensional Environmental Profiles - Campinas Metropolitan Region, 2007 (end)

<i>Environmental behavior</i>	Absolute Frequency	Observed Probability	Profile 1 λ_{1ji} (Ratio E/O)	Profile 2 λ_{2ji} (Ratio E/O)	Profile 3 λ_{3ji} (Ratio E/O)	Profile 4 λ_{4ji} (Ratio E/O)
<i>Intended behavior</i>						
1 - Would you consider separating garbage or trash for recycling?						
No	142	0.079	0.103 (1.3)	0.000 (0.0)	0.237 (3.0)	0.000 (0.0)
Yes	1664	0.921	0.897 (1.0)	1.000 (1.1)	0.764 (0.8)	1.000 (1.1)
2 - Would you consider eliminating unnecessary waste of water?						
No	33	0.018	0.000 (0.0)	0.000 (0.0)	0.105 (5.7)	0.000 (0.0)
Yes	1773	0.982	1.000 (1.0)	1.000 (1.0)	0.895 (0.9)	1.000 (1.0)
3 - Would you consider reducing gas and energy consumption?						
No	47	0.026	0.000 (0.0)	0.000 (0.0)	0.150 (5.8)	0.000 (0.0)
Yes	1759	0.974	1.000 (1.0)	1.000 (1.0)	0.850 (0.9)	1.000 (1.0)
4 - Would you consider working collectively with others?						
No	984	0.545	1.000 (1.8)	0.000 (0.0)	1.000 (1.8)	0.000 (0.0)
Yes	822	0.455	0.000 (0.0)	1.000 (2.2)	0.000 (0.0)	1.000 (2.2)
5 - Would you consider taking collective action against a company that pollutes?						
No	954	0.528	1.000 (1.9)	0.000 (0.0)	1.000 (1.9)	0.000 (0.0)
Yes	852	0.472	0.000 (0.0)	1.000 (2.1)	0.000 (0.0)	1.000 (2.1)
6 - Would you consider contributing with/to environmental organizations?						
No	1050	0.581	1.000 (1.7)	0.000 (0.0)	1.000 (1.7)	0.000 (0.0)
Yes	756	0.419	0.000 (0.0)	1.000 (2.4)	0.000 (0.0)	1.000 (2.4)
7 - Would you consider paying more for foods without chemical products?						
No	1092	0.605	1.000 (1.7)	0.000 (0.0)	1.000 (1.7)	0.000 (0.0)
Yes	714	0.395	0.000 (0.0)	1.000 (2.5)	0.000 (0.0)	1.000 (2.5)
8 - Would you consider buying more energy efficient household appliances?						
No	168	0.093	0.000 (0.0)	0.000 (0.0)	0.532 (5.7)	0.000 (0.0)
Yes	1638	0.907	1.000 (1.1)	1.000 (1.1)	0.469 (0.5)	1.000 (1.1)
<i>Actual behavior</i>						
1 - In the past 12 months have you avoided throwing toxic products in the trash?						
No	692	0.383	0.708 (1.8)	0.000 (0.0)	0.797 (2.1)	0.000 (0.0)
Yes	1114	0.617	0.292 (0.5)	1.000 (1.6)	0.203 (0.3)	1.000 (1.6)
2 - In the past 12 months have you avoided buying a product because of information written on the label?						
No	842	0.466	0.000 (0.0)	0.000 (0.0)	1.000 (2.1)	1.000 (2.1)
Yes	964	0.534	1.000 (1.9)	1.000 (1.9)	0.000 (0.0)	0.000 (0.0)
3 - In the past 12 months have you fixed a broken product in order to avoid buying a new one?						
No	372	0.206	0.000 (0.0)	0.000 (0.0)	0.623 (3.0)	0.376 (1.6)
Yes	1434	0.794	1.000 (1.3)	1.000 (1.3)	0.378 (0.5)	0.624 (0.8)
4 - In the past 12 months have you decreased the consumption of meat for health reasons?						
No	920	0.509	0.552 (1.1)	0.000 (0.0)	0.776 (1.5)	0.727 (1.4)
Yes	886	0.491	0.448 (0.9)	1.000 (2.0)	0.224 (0.5)	0.273 (0.6)
5 - In the past 12 months have you stopped buying a product because you thought it harmed the environment?						
No	1225	0.678	0.740 (1.1)	0.000 (0.0)	1.000 (1.5)	1.000 (1.5)
Yes	581	0.322	0.260 (0.8)	1.000 (3.1)	0.000 (0.0)	0.000 (0.0)

Source: Data from Projeto Vulnerability (NEPO/Unicamp)

Table B - Descriptive Statistics for Selected Variables, Estimated Probabilities of Response and Ratio E/O of Multidimensional Environmental Profiles – Baixada Santista Metropolitan Region, 2007 (continues)

<i>Residential and neighborhood environment</i>	Absolute Frequency	Observed Probability	Profile 1 λ_{1ji} (Ratio E/O)	Profile 2 λ_{2ji} (Ratio E/O)	Profile 3 λ_{3ji} (Ratio E/O)	Profile 4 λ_{4ji} (Ratio E/O)
1 - Current municipality of residence						
Bertioga	32	0.020	0.000 (0.0)	0.000 (0.0)	0.132 (6.6)	0.000 (0.0)
Cubatao	79	0.050	0.097 (2.0)	0.000 (0.0)	0.125 (2.5)	0.039 (0.8)
Guaruja	241	0.152	0.000 (0.0)	0.216 (1.4)	0.616 (4.1)	0.000 (0.0)
Itanhaem	58	0.037	0.011 (0.3)	0.072 (2.0)	0.077 (2.1)	0.000 (0.0)
Mongagua	56	0.035	0.035 (1.0)	0.092 (2.6)	0.000 (0.0)	0.000 (0.0)
Peruibe	39	0.025	0.143 (5.8)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Praia Grande	230	0.145	0.132 (0.9)	0.357 (2.5)	0.000 (0.0)	0.000 (0.0)
Santos	516	0.325	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.875 (2.7)
Sao Vicente	335	0.211	0.581 (2.8)	0.263 (1.2)	0.050 (0.2)	0.087 (0.4)
2 - Conditions of the street surface						
Paved in good condition	1093	0.689	0.500 (0.7)	0.868 (1.3)	0.000 (0.0)	1.000 (1.5)
Paved with pot holes	193	0.122	0.500 (4.1)	0.132 (1.1)	0.000 (0.0)	0.000 (0.0)
Not paved - regular surface	122	0.077	0.000 (0.0)	0.000 (0.0)	0.419 (5.5)	0.000 (0.0)
Not paved - irregular surface	178	0.112	0.000 (0.0)	0.000 (0.0)	0.581 (5.2)	0.000 (0.0)
3 - Does the street have curb and gutter?						
No	300	0.189	0.000 (0.0)	0.000 (0.0)	1.000 (5.3)	0.000 (0.0)
Yes	1286	0.811	1.000 (1.2)	1.000 (1.2)	0.000 (0.0)	1.000 (1.2)
4 - Does the street have sidewalks?						
No	299	0.189	0.000 (0.0)	0.000 (0.0)	1.000 (5.3)	0.000 (0.0)
Yes	1287	0.811	1.000 (1.2)	1.000 (1.2)	0.000 (0.0)	1.000 (1.2)
5 - Does the street have public lighting?						
No	61	0.038	0.000 (0.0)	0.000 (0.0)	0.243 (6.3)	0.000 (0.0)
Yes	1525	0.962	1.000 (1.0)	1.000 (1.0)	0.757 (0.8)	1.000 (1.0)
6 - What's the frequency of the water supply?						
Continuous - the whole day	1469	0.926	0.973 (1.1)	0.957 (1.0)	0.648 (0.7)	1.000 (1.0)
Some hours per day	36	0.023	0.000 (0.0)	0.043 (1.9)	0.060 (2.6)	0.000 (0.0)
Discontinuous	50	0.032	0.027 (0.9)	0.000 (0.0)	0.169 (5.3)	0.000 (0.0)
Missing	31	0.020	0.000 (0.0)	0.000 (0.0)	0.123 (6.3)	0.000 (0.0)
7 - Type of sewage drain						
General sewage system	1300	0.820	0.886 (1.1)	0.976 (1.2)	0.151 (0.2)	1.000 (1.2)
Septic tank	66	0.042	0.114 (2.7)	0.024 (0.6)	0.086 (2.1)	0.000 (0.0)
Simple cesspools	44	0.028	0.000 (0.0)	0.000 (0.0)	0.167 (6.0)	0.000 (0.0)
Throw into rivers / missing	176	0.111	0.000 (0.0)	0.000 (0.0)	0.596 (5.4)	0.000 (0.0)
8 - Frequency of garbage and trash collection						
Discontinuous	769	0.485	0.829 (1.7)	1.000 (2.1)	0.623 (1.3)	0.000 (0.0)
Daily	728	0.459	0.171 (0.4)	0.000 (0.0)	0.000 (0.0)	1.000 (2.2)
Missing	89	0.056	0.000 (0.0)	0.000 (0.0)	0.377 (6.7)	0.000 (0.0)

Source: Data from Projeto Vulnerability (NEPO/Unicamp)

Table B - Descriptive Statistics for Selected Variables, Estimated Probabilities of Response and Ratio E/O of Multidimensional Environmental Profiles – Baixada Santista Metropolitan Region, 2007 (continues)

<i>Socioeconomic status of the household</i>	Absolute Frequency	Observed Probability	Profile 1 λ_{1ji} (Ratio E/O)	Profile 2 λ_{2ji} (Ratio E/O)	Profile 3 λ_{3ji} (Ratio E/O)	Profile 4 λ_{4ji} (Ratio E/O)
1 - Schooling of respondent						
Illiterate	52	0.033	0.152 (4.6)	0.000 (0.0)	0.036 (1.1)	0.000 (0.0)
1 to 4 years	339	0.214	0.447 (2.1)	0.286 (1.3)	0.280 (1.3)	0.000 (0.0)
5 to 8 years	475	0.299	0.277 (0.9)	0.330 (1.1)	0.600 (2.0)	0.145 (0.5)
9 to 11 years	528	0.333	0.124 (0.4)	0.384 (1.2)	0.084 (0.3)	0.504 (1.5)
12 years and more	192	0.121	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.351 (2.9)
2 - Deciles of per capita household income						
First	136	0.086	0.097 (1.1)	0.138 (1.6)	0.158 (1.8)	0.000 (0.0)
Second	141	0.089	0.151 (1.7)	0.080 (0.9)	0.225 (2.5)	0.000 (0.0)
Third	130	0.082	0.116 (1.4)	0.065 (0.8)	0.244 (3.0)	0.000 (0.0)
Forth	151	0.095	0.186 (2.0)	0.097 (1.0)	0.200 (2.1)	0.000 (0.0)
Fifth	148	0.093	0.176 (1.9)	0.160 (1.7)	0.088 (0.9)	0.000 (0.0)
Sixth	124	0.078	0.148 (1.9)	0.143 (1.8)	0.054 (0.7)	0.000 (0.0)
Seventh	152	0.096	0.060 (0.6)	0.165 (1.7)	0.002 (0.0)	0.096 (1.0)
Eighth	157	0.099	0.035 (0.4)	0.153 (1.5)	0.030 (0.3)	0.116 (1.2)
Ninth	212	0.134	0.032 (0.2)	0.000 (0.0)	0.000 (0.0)	0.365 (2.7)
Tenth	235	0.148	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.423 (2.9)
3 - Social class of the household						
Classes D and E	337	0.212	0.442 (2.1)	0.137 (0.6)	0.553 (2.6)	0.000 (0.0)
Class C	750	0.473	0.558 (1.2)	0.863 (1.8)	0.447 (0.9)	0.103 (0.2)
Class B	450	0.284	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.810 (2.9)
Class A	49	0.031	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.087 (2.8)

Source: Data from Projeto Vulnerability (NEPO/Unicamp)

Table B - Descriptive Statistics for Selected Variables, Estimated Probabilities of Response and Ratio E/O of Multidimensional Environmental Profiles – Baixada Santista Metropolitan Region, 2007 (continues)

<i>Environmental perception</i>	Absolute Frequency	Observed Probability	Profile 1 λ_{1ji} (Ratio E/O)	Profile 2 λ_{2ji} (Ratio E/O)	Profile 3 λ_{3ji} (Ratio E/O)	Profile 4 λ_{4ji} (Ratio E/O)
1 - In your opinion, what is the main problem in regards to the environment in Brazil?						
Environmental sanitation	94	0.059	0.000 (0.0)	0.030 (0.5)	0.174 (2.9)	0.068 (1.2)
Pollution of rivers, lakes, beaches	246	0.155	0.000 (0.0)	0.256 (1.7)	0.119 (0.8)	0.165 (1.1)
Air pollution	222	0.140	0.084 (0.6)	0.175 (1.2)	0.051 (0.4)	0.177 (1.3)
Deforestation	457	0.288	0.000 (0.0)	0.224 (0.8)	0.502 (1.7)	0.427 (1.5)
Lack of green spaces	30	0.019	0.000 (0.0)	0.047 (2.5)	0.029 (1.5)	0.000 (0.0)
Floods	51	0.032	0.000 (0.0)	0.073 (2.3)	0.011 (0.3)	0.022 (0.7)
Fire	132	0.083	0.000 (0.0)	0.053 (0.6)	0.114 (1.4)	0.140 (1.7)
Other / No problems	164	0.103	0.315 (3.0)	0.142 (1.4)	0.000 (0.0)	0.000 (0.0)
Missing	190	0.120	0.601 (5.0)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
2 - In your opinion, what is the main problem with the environ						
Environmental sanitation	174	0.110	0.000 (0.0)	0.000 (0.0)	0.465 (4.2)	0.105 (1.0)
Pollution of rivers, lakes, beaches	340	0.214	0.000 (0.0)	0.169 (0.8)	0.265 (1.2)	0.342 (1.6)
Air pollution	129	0.081	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.230 (2.8)
Deforestation	36	0.023	0.000 (0.0)	0.019 (0.8)	0.050 (2.2)	0.025 (1.1)
Lack of green spaces	88	0.055	0.000 (0.0)	0.180 (3.2)	0.000 (0.0)	0.000 (0.0)
Floods	115	0.073	0.000 (0.0)	0.235 (3.2)	0.000 (0.0)	0.000 (0.0)
Other / No problems	581	0.366	0.571 (1.6)	0.397 (1.1)	0.220 (0.6)	0.297 (0.8)
Missing	123	0.078	0.429 (5.5)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
3 - In your opinion, how serious is global warming?						
Very serious	1319	0.832	0.000 (0.0)	0.924 (1.1)	0.963 (1.2)	1.000 (1.2)
Slightly serious	73	0.046	0.096 (2.1)	0.076 (1.6)	0.037 (0.8)	0.000 (0.0)
Not serious	25	0.016	0.090 (5.7)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Doesn't know about GW/Missing	169	0.107	0.813 (7.6)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
4 - In your opinion, who should/could solve the problem of gl						
Each one of us	721	0.455	0.000 (0.0)	0.701 (1.5)	0.187 (0.4)	0.526 (1.2)
Local government	82	0.052	0.000 (0.0)	0.155 (3.0)	0.023 (0.4)	0.000 (0.0)
State government	20	0.013	0.011 (0.8)	0.007 (0.5)	0.042 (3.3)	0.006 (0.5)
Federal government	247	0.156	0.085 (0.5)	0.056 (0.4)	0.474 (3.0)	0.163 (1.0)
International organizations	24	0.015	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.042 (2.8)
Ecological entities/organizations	19	0.012	0.000 (0.0)	0.025 (2.1)	0.005 (0.4)	0.010 (0.8)
World leaders	127	0.080	0.000 (0.0)	0.000 (0.0)	0.085 (1.1)	0.184 (2.3)
Entrepreneurs	69	0.044	0.000 (0.0)	0.000 (0.0)	0.125 (2.9)	0.069 (1.6)
Others	63	0.040	0.133 (3.3)	0.034 (0.8)	0.037 (0.9)	0.000 (0.0)
GW is not serious / never heard of	194	0.122	0.761 (6.2)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Missing	20	0.013	0.011 (0.8)	0.022 (1.8)	0.024 (1.9)	0.000 (0.0)
5 - In your opinion, who should/could solve the environmenta						
Each one of us	480	0.303	0.105 (0.3)	0.391 (1.3)	0.159 (0.5)	0.399 (1.3)
Local government	463	0.292	0.412 (1.4)	0.308 (1.1)	0.483 (1.7)	0.130 (0.4)
State government	55	0.035	0.011 (0.3)	0.041 (1.2)	0.059 (1.7)	0.031 (0.9)
Federal government	305	0.192	0.075 (0.4)	0.131 (0.7)	0.242 (1.3)	0.285 (1.5)
International organizations	18	0.011	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.032 (2.8)
Ecological entities/organizations	24	0.015	0.000 (0.0)	0.035 (2.3)	0.000 (0.0)	0.012 (0.8)
World leaders	78	0.049	0.000 (0.0)	0.052 (1.1)	0.000 (0.0)	0.094 (1.9)
Entrepreneurs	31	0.020	0.000 (0.0)	0.043 (2.2)	0.000 (0.0)	0.018 (0.9)
Others	132	0.083	0.397 (4.8)	0.000 (0.0)	0.058 (0.7)	0.000 (0.0)

Source: Data from Projeto Vulnerability (NEPO/Unicamp)

Table B - Descriptive Statistics for Selected Variables, Estimated Probabilities of Response and Ratio E/O of Multidimensional Environmental Profiles – Baixada Santista Metropolitan Region, 2007 (end)

<i>Environmental behavior</i>	Absolute Frequency	Observed Probability	Profile 1 λ_{1ji} (Ratio E/O)	Profile 2 λ_{2ji} (Ratio E/O)	Profile 3 λ_{3ji} (Ratio E/O)	Profile 4 λ_{4ji} (Ratio E/O)
<i>Intended behavior</i>						
1 - Would you consider separating garbage or trash for recycling?						
No	112	0.071	0.384 (5.4)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Yes	1474	0.929	0.616 (0.7)	1.000 (1.1)	1.000 (1.1)	1.000 (1.1)
2 - Would you consider eliminating unnecessary waste of water?						
No	13	0.008	0.041 (5.0)	0.000 (0.0)	0.005 (0.7)	0.000 (0.0)
Yes	1573	0.992	0.959 (1.0)	1.000 (1.0)	0.995 (1.0)	1.000 (1.0)
3 - Would you consider reducing gas and energy consumption?						
No	20	0.013	0.070 (5.6)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Yes	1566	0.987	0.930 (0.9)	1.000 (1.0)	1.000 (1.0)	1.000 (1.0)
4 - Would you consider working collectively with others?						
No	420	0.265	1.000 (3.8)	0.000 (0.0)	0.000 (0.0)	0.112 (0.4)
Yes	1166	0.735	0.000 (0.0)	1.000 (1.4)	1.000 (1.4)	0.888 (1.2)
5 - Would you consider taking collective action against a company?						
No	343	0.216	1.000 (4.6)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Yes	1243	0.784	0.000 (0.0)	1.000 (1.3)	1.000 (1.3)	1.000 (1.3)
6 - Would you consider contributing with/to environmental or social projects?						
No	389	0.245	1.000 (4.1)	0.000 (0.0)	0.177 (0.7)	0.000 (0.0)
Yes	1197	0.755	0.000 (0.0)	1.000 (1.3)	0.823 (1.1)	1.000 (1.3)
7 - Would you consider paying more for foods without chemical preservatives?						
No	697	0.439	1.000 (2.3)	0.203 (0.5)	0.559 (1.3)	0.350 (0.8)
Yes	889	0.561	0.000 (0.0)	0.797 (1.4)	0.441 (0.8)	0.651 (1.2)
8 - Would you consider buying more energy efficient household appliances?						
No	65	0.041	0.229 (5.6)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
Yes	1521	0.959	0.771 (0.8)	1.000 (1.0)	1.000 (1.0)	1.000 (1.0)
<i>Actual behavior</i>						
1 - In the past 12 months have you avoided throwing toxic products in the trash?						
No	386	0.243	0.602 (2.5)	0.000 (0.0)	1.000 (4.1)	0.000 (0.0)
Yes	1200	0.757	0.398 (0.5)	1.000 (1.3)	0.000 (0.0)	1.000 (1.3)
2 - In the past 12 months have you avoided buying a product that is not environmentally friendly?						
No	668	0.421	1.000 (2.4)	0.000 (0.0)	1.000 (2.4)	0.152 (0.4)
Yes	918	0.579	0.000 (0.0)	1.000 (1.7)	0.000 (0.0)	0.848 (1.5)
3 - In the past 12 months have you fixed a broken product in your home?						
No	396	0.250	0.392 (1.6)	0.124 (0.5)	0.561 (2.2)	0.148 (0.6)
Yes	1190	0.750	0.608 (0.8)	0.876 (1.2)	0.439 (0.6)	0.852 (1.1)
4 - In the past 12 months have you decreased the consumption of energy?						
No	882	0.556	0.613 (1.1)	0.416 (0.7)	1.000 (1.8)	0.453 (0.8)
Yes	704	0.444	0.387 (0.9)	0.584 (1.3)	0.000 (0.0)	0.547 (1.2)
5 - In the past 12 months have you stopped buying a product that is not environmentally friendly?						
No	751	0.474	1.000 (2.1)	0.000 (0.0)	1.000 (2.1)	0.240 (0.5)
Yes	835	0.526	0.000 (0.0)	1.000 (1.9)	0.000 (0.0)	0.761 (1.4)

Source: Data from Projeto Vulnerability (NEPO/Unicamp)

Table C: Correlation between Environmental Vulnerability and Awareness about Global Warming (Logit Regression – 0 = heard of GW / 1 = hasn't heard of global warming)

Variables	CMA	BSMA
Inverse of Environmental Vulnerability Scalar	-3.096*** (0.759)	0.463 (0.585)
Low social stratum	-3.107*** (1.066)	-0.164 (0.591)
EVS*Social Stratum	2.622** (1.243)	-1.823** (0.773)
Age	0.0386*** (0.0101)	0.0176*** (0.00636)
Male	-0.378 (0.236)	-0.0257 (0.210)
Native	-0.122 (0.353)	-0.0232 (0.255)
Illiterate (base)		
1 to 4 years	-0.640** (0.273)	-1.754*** (0.370)
5 to 8 years	-1.250*** (0.420)	-2.213*** (0.383)
9 to 11 years	-2.537*** (0.711)	-2.855*** (0.425)
12+ years	-2.830*** (1.066)	-4.596*** (1.072)
Constant	-0.522 (0.790)	-0.138 (0.629)
Pseudo R2		
Observations	1,806	1,586

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Projeto Vulnerabilidade (NEPO/Unicamp)