Education level and income are important for good environmental awareness: a case study from south Brazil

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Abstract. The relationship between people and the environment is critical for the development of projects and actions towards the sustainable use of nature resources. This study investigated the relationship between a number of socio-demographic variables and environmental awareness in two cities of southern Brazil (Maringá and Sarandí). We found that levels of education and income were positively associated with environmental awareness. Individuals with higher level of education were 3.2 times more likely to have good environmental awareness than individuals with a lower level. Our results contribute to understand social-ecological interactions of urban citizens from this region and to develop management actions to involve urban residents into environmental conservation actions.

[Keywords: generalized linear models, human ecology, multinomial regression, socio-demographic, urban ecology]

Resumen. El nivel de educación y los ingresos son importantes para la buena conciencia ambiental: un estudio de caso desde el sur de Brasil. Uno de los propósitos de la ecología humana es comprender las relaciones entre las personas y el ambiente, a fin de apoyar el desarrollo de proyectos y acciones que permitan el uso sostenible de la naturaleza. En este estudio se investigó la relación entre variables socio-demográficas y el nivel de conciencia ambiental en dos ciudades del sur de Brasil (Maringá y Sarandí). Los resultados mostraron que el nivel de educación y el de ingresos se relacionaron de forma positiva con la conciencia ambiental. Los individuos con mayor nivel de educación poseen 3.2 veces más probabilidades de tener una buena conciencia ambiental que los que presentan una menor escolaridad. Estos resultados mejoran nuestra comprensión sobre las interacciones socio-ecológicas de los ciudadanos de esta región del país y pueden brindar soporte a medidas de gestión para involucrar a los residentes en acciones de conservación del ambiente.

[Palabras clave: modelos lineales generalizados, ecología humana, regresión multinomial, ecología urbana]

Introduction

Nature in cities is represented by parks, squares, wooded areas, residential and public gardens. This configuration of the landscape promotes a closer relationship between man and the environment. Many studies have focused on the complex dynamics of social and environmental factors that shape the actions and awareness of humans and its relationship with nature (Bhatti and Church 2001; Barnett et al. unpublished data) and on which variables are good predictors for pro-environmental attitudes and behaviors (Fransson and Gärling 1999; Schwartz 2012; Gifford and Nilsson 2014). Environmental concern and responsible behavior are affected by a complex interaction between variables such as attitudes, beliefs, values and socio-demographic characteristics (Hawthorne and Alabaster 1999). Each individual perceives, reacts and responds differently to actions that involve them, assigning different aesthetic, economic and/or ecological values to these actions (Melazo 2005; Marques et al. 2006; Shackleton et al. 2015). Thus, diverse cultures, socioeconomic groups and urban realities may, directly or indirectly, influence the awareness people have with regard to environment conservation.

A number of individual basic values (e.g., self-direction, hedonism, security) can be used to explain the motivational bases for the different attitudes and behaviors (Schwartz 2012). Nevertheless, some values can conflict with others (e.g., values emphasizing concern for the welfare and interest of others, as universalism, benevolence and protecting the environment) values that emphasize pursuit of one's own interests and relative success (power, wealth). The nature and structure of these values may be universal, but individuals and groups may attribute to

them different relative importance, resulting in different attitudes and behaviors (Schwartz 2012). On the other hand, there are socio-demographic variables that can influence or predict environment concern (Dietz et al. 1998). Age and educational level are believed to have strong association with environmental concerns (Zelezny et al. 2000; Vicente-Molina et al. 2013). Gender may also influence the environmental concern although empirical evidence is diverse (Xiao and McCright 2015; Palavecinos et al. 2016). However, some studies suggest that socio-demographic factors may play a minor role in behavior compared to psychological factors, and point out the limited theoretical argumentation on the relationship between socio-demographic variables and environmental concern (Dietz et al. 1998; Diamantopoulos et al. 2003; Pisano and Hidalgo 2014).

Determining the factors that shape pro-environmental attitudes and behaviors can help in various ways to protect nature, as well, the ecosystem services provided, and consequently, people wealth. Moreover, understanding the role of socio-demographic factors in shaping environmentalism can provide a theoretical framework to enhance or further develop theories. In summary, the knowledge about which factors would result in individuals with pro-environmental attitudes and behaviors may help to establish appropriate environmental policies, educational programs and communication strategies that will promote the conservation of natural resources as well as the quality of life arising from the coexistence of people with nature in urban centers (Keniger et al. 2013).

This study identified the socio-demographic factors related to environmental awareness in a sample of residents of two towns in southern Brazil. Environmental awareness was measured through interviews which compiled information about the attitudes and behaviors of individuals in relation to the environment preservation, as well as how they dealt with waste production and disposal and how they care of their own backyards. It was expected that young people with a higher education level and greater family income would show good environmental awareness in relation to older individuals with a lower education level and less income.

MATERIALS AND METHODS

The cities of Maringá and Sarandí are located in the northwest of the state of Paraná, southern Brazil. Maringá is a medium-sized city and has a population of ~390000 inhabitants (Rodrigues 2004a; IBGE 2014). Sarandí is a small town of about 90000 inhabitants (IBGE 2014), and is located in the metropolitan region of Maringá. The current configuration of the urban space in the metropolitan region of Maringá is the result of actions guided by the local real-estate market, which produces social inequality. The city of Maringá has the highest home price index in the area, thus families with low income usually move to the nearest municipalities, mainly Paiçandu and Sarandí. In these cities, home price index is cheap, and the municipal legislative framework is much less rigorous, allowing the commercialization of residential areas which there are no basic services and city infrastructure (Rodrigues 2004b). Since 1980, there has been a clear process of conurbation between the cities of Maringá, Sarandí and Paiçandu, comprising a continuous urban area, whose total population is about 476000 people. Despite of the conurbation, socioeconomic differences between Sarandí and Maringá are sharp. In 2000, while Maringá occupied the 63rd position in the Municipal Human Development Index, Sarandí occupied the 1367th position, in a universe of 5444 cities (Rodrigues 2004b).

Data collection was performed by Angeoletto (2012), and derived from the *Projeto Ecología Urbana en Regiones Metropolitanas de Brasil: Paisaje, calidad de vida y desarrollo humano* (ECOURBE). Samples were obtained with a 95% confidence level and a margin of error of 5%. From four neighborhoods in the city of Sarandí, it was obtained a random sample of 33 houses in Jardim das Torres, 132 in Jardim Universal, 92 in Jardim Bom Pastor and 42 in Conjunto Triangulo, totalizing 299 houses. In the Zona 2 neighborhood, in the city of Maringá, the random sample comprised 261 homes. After the houses were identified, the interviewer visited each residence and interviewed a family resident with at least 15 years old. Before the interviews started, we adjusted the questionnaire by a pilot interview performed in 20 homes, randomly chosen in Jardim Universal neighborhood.

The socio-demographic variables adopted were gender (male and female), age (15-34, and more than 35), education (high school incomplete, and at least high school completed), monthly income (five minimum wages, and more than five minimum wages), social class (low and high), type of residence (rented, and ownership), and city (Maringá and Sarandí. The questionnaire contained

questions about the use and management of yards, waste management and environmental awareness (Angeoletto 2012). Therefore, in this study, environmental awareness was measured through attitudes and behaviors of individuals in relation to the preservation of the environment, as well as how they look after waste and their own backyards. The answers of the questions had five to six statements ranging, in a Likert scale, from one (highly unfavorable/strongly disagree) to five/six (highly favorable/strongly agree). This value assigned by the Likert scale was the score for each question. At the end of the interview, for each participant the scores were summed up over all questions, creating the variable total score. As the purpose of the study was to investigate three levels of environmental awareness (good, regular, and poor), the total variable score of the participants were divided into three clusters, through a k-means cluster analysis (with Euclidian distance and a random initial cluster centroid). This analysis allowed to identify three groups with highest difference between the values of the total score, and the lowest difference inside each cluster. The highest mean score of the three clusters was set as the good environmental awareness, the second highest and the lowest mean scores were set as the regular and poor environmental awareness, respectively. From an initial sample size of 560 houses, 6 were discarded as their questionnaires were incomplete.

To identify the determining socio-demographic factors, an univariate analysis was initially performed using Fisher's and/or χ^2 independence tests. For variables with significance level lower than 20%, as recommended by Hosmer et al. (2013), we adjusted the multinomial logistic regression, allowing us to identify which factors are determinant for environmental awareness. The multinomial logistic regression allowed to estimate an odds ratio (OR) and the confidence intervals (CI 95%) between the categories of environmental awareness (good, regular and poor) (Dobson and Barnett 2008). As the adjusted model will not be adopted to make predictions, an assessment of the goodness of fit of the model or a deviance analysis were not carried out. To validate the model, we considered three criteria: the likelihood ratio test (LRT), Score test (ST) and the Wald test (TW) (Agresti 1990). Statistical analyses were performed using SAS software (version 9.1, SAS Institute Inc., Cary, NC).

RESULTS AND DISCUSSION

A regular environmental awareness was the most frequent category (Figure 1). Individuals with total scores of 3 to 16, -6 to 2, and -7 to -25; belonged to the categorical levels of good, regular, and poor environmental awareness, respectively (Table 1). Gender (*P*=0.46), age group (*P*=0.5) and type of residence (*P*=0.3) were not significant as predictors of environmental awareness. Thus, only education (*P*<0.001), monthly income (*P*<0.0001), social class (*P*<0.002) and city (*P*<0.0013) were included in the multinomial logistic model. The results of the tests to validate the model indicated that at least one of the parameters was different from zero (TRV:χ^2: 47.88, *P*<0.0001; TS:χ^2: 48.37, *P*<0.0001; TW: χ^2: 43.29, *P*<0.0001). According to the coefficient of variation, the parameter estimates for the model being studied were not accurate and the values are very different from 30 (Table 2). The analysis showed that the higher the education level and the monthly income, the stronger the association with good environmental awareness (2.4 and 4.2 times, respectively) while, for a regular environmental awareness, only a high education level showed a strong associated (5 times) (Table 2).

In contrast to other evidence (Zelezny et al. 2000; Czap and Czap 2010; Hunter et al. 2004; Liberty and Hong Juan 2010; Vicente-Molina et al. 2013), our results showed no gender differences in environmental attitudes and behaviors. This discrepancy could arise due to differences in the samples analyzed. In our
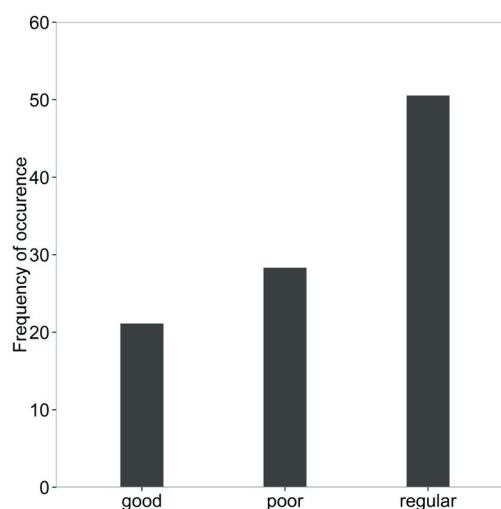
Figure 1. Ocurrence frequency (as a percentage) of the environmental awareness variable levels.

Figura 1. Frecuencia de aparición (en porcentaje) de los niveles de la variable conciencia ambiental.

Table 1. Descriptive measures of the score variable and correspondence with the categorical variable of environmental awareness (EA) and EA respective categories (SD: standard deviation; Min: minimum; Max: maximum).

Tabla 1. Medidas descriptivas de la variable de puntuación y la correspondencia con la variable categórica de la conciencia ambiental (EA) y EA respectivas categorías (SD: desviación estándar; Min: mínimo; Max: máximo).

Levels of the EA variable	Score variable				
	N	Mean	SD	Min	Max
Good	117	6.22	2.73	03	16
Regular	280	-2.11	2.55	-06	02
Poor	157	-11.24	3.99	-25	-07
Total	554	-2.95	6.87	-25	16

Table 2. Odds ratio (OR) and confidence intervals (95%) of the multinomial logistic regression model adjusted for significant socio-demographic variables, with environmental awareness as a dependent variable (poor environmental awareness as a reference category) (* indicates which level of variable was taken as a reference).

Tabla 2. Razón de probabilidades (OR) e intervalos de confianza (95%) del modelo de regresión logística multinomial ajustado por variables socio-demográficas significativas. Se utilizó la conciencia ambiental como variable dependiente (mala conciencia ambiental como categoría de referencia) (* indica que se tomó el nivel de la variable como referencia).

Variable	Environmental Awareness Model	
	good vs. poor	regular vs. poor
	OR (CI 95%)	
Education level		
Unfinished high school *	1	1
Finished high school	0.241 (0.130-0.446)	0.504 (0.307-0.830)
Monthly Income		
Up to 5 minimum wages *	1	1
More than 5 minimum wages	0.417 (0.217-0.802)	0.673 (0.405-1.120)
Social Class		
High *	1	1
Low	1.171 (0.540-2.538)	0.969 (0.524-1.792)
City		
Maringá *	1	1
Sarandí	1.210 (0.550-2.661)	1.257 (0.682-2.319)

study, and in Pisano and Hidalgo (2014), who found similar results, the samples consisted of residents/households, reflecting a more general sample that did not encompass only university communities, as the studies mentioned above. Besides, gender may have considerable indirect association with environmental concern via other factors, such as environmental knowledge (Xiao and Hong 2010). The conflicting conclusions observed until here, give evidence that the role that gender play in environmental attitudes

and behaviors may be more intricate than was thought. Another possible explanation is that over the past few years, the relationship between gender and the environment may be changing, weakening the trend where women are more influential than men when environmental awareness comes to matter (Zelezny et al. 2000).

Both young and older people were identified as individuals with greater environmental concern (Arcury 1990; Ewert and Baker 2001; Shen and Saijo 2008; Czap and Czap 2010; Liberty and HongJuan 2010). Once again, the composition of the sample used in the current study, representing the urban community at large, rather than the academic community, may have been the cause for the non-significance of age. However, the work of Shen and Saijo (2008), who used a general sample of residents from the city of Shanghai, demonstrated that results regarding variables such as gender and age were significantly different from those found in western studies. These authors suggested that these differences may be due to cultural differences, the economy and the environmental damage of each country, suggesting that studies should be conducted to identify unique factors for each nation. Furthermore, environmental awareness may result from the interaction between socio-demographic variables. For example, older people showed positive behavior towards the environment and these individuals had also advanced further in their education level (Liberty and HongJuan 2010). In this way, future studies should investigate not only the effects of variables on environmental awareness but also the interactions between the independent variables.

In our study, education and income showed an association with good and regular environmental awareness, a pattern largely documented in other contexts (Jones and Dunlap 1992; Klinenberg et al. 1998; Vaske et al. 2001; Olofsson and Öhman 2006; Xiao and Dunlap 2007; Shen and Saijo 2008; Liberty and HongJuan 2010). Individuals with high levels of education tend to better understand environmental issues and thus become more concerned in relation to environmental quality and more motivated to practice environmentally responsible behavior (Maloney et al. 1975; Ewert and Baker 2001; Liberty and HongJuan 2010). Education can increase the ability to understand complex and large-scale problems, as well as to develop a generalized view or a collection of beliefs,

attitudes and perspectives on the importance of the natural environment and its relationship with human being.

The strong association between income and environmental awareness is also supported by other evidence (Xiao and Dunlap 2007; Shen and Saijo 2008). Individuals with lower monthly income might be less concerned for the environment since their salaries are only sufficient for survival. Besides, middle/high class individuals usually have the formal education necessary to become conscious of the environmental consequences associated with the impact of human activities on the environment. It is believed that the concern for environmental quality "per se" lies within the domain of luxurious things, that is to say, it is something that an individual can aspire to only after achieving basic material needs, such as adequate food, shelter and economic security (Shen and Saijo 2008). Citizens with lower income tend to give higher importance to self-security value (here assumed to be related to basic human needs, of self or family security) than to universalism value (protection of the nature), resulting in attitudes and behaviors that primarily aim to attain and maintain the security of self and family security. In turn, individuals with middle/high income can prioritize pro-environmental behaviors, since the self-security value is already attained. Beyond the scope of values, good or regular environmental awareness may be hampered due to a barrier imposed by low income, which does not allow a person to practice some pro-environmental behaviors, such as purchase solar panels (Gifford 2011; Gifford and Nilsson 2014). Thus, income variable can act as a structural reason for the lack of good/regular environmental awareness observed for low income residents in our study, even when the individual has nature protection as a high priority value.

The large percentage of individuals with regular environmental awareness indicates that the issue of environmental preservation needs to be imparted in the studied community. In general, people do not seem to have good environmental concern, represented by the minority of individuals with good environmental awareness observed in our study. This finding may be related to the tradition value (Schwartz 2012), as people always had the belief that natural resources were infinite. But, with a new scenario that natural resources need to be protected, good environmental awareness is expected to increase along time since people will respond and change behavior from the past perspective. Another observation to be made is that, according to the literature and the results obtained in this study, the use of only socio-demographic variables may not be sufficient to model environmental awareness. It is suggested that, in addition to these variables, other factors such as psychological ones, past experience, monetary concerns, type of academic background, ethnic variations and knowledge of environmental issues should be included. These factors can play an important role in determining environmental attitudes and behaviors. A change from the descriptive approach, generally adopted in this type of study, to an approach that seeks to explain the relationships between the various factors involved and environmental awareness is also recommended. In addition, a methodological suggestion for future studies would be: a) to take into account jointly the different dimensions (social, psychological, cultural) of environmental awareness, to develop valid and reliable measures that can represent it faithfully, and b) the use of more advanced statistical analysis, complementing the use of exploratory analyses. The adoption of a robust statistical framework and the consideration of both social and psychological dimensions, particularly in Brazilian research, will help to clarify the relationships and the processes that shape the most basic values, through general beliefs, attitudes and specific behaviors of individuals in relation to environmental awareness and conservation.

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