Research Article

Students' perception of urban and rural environmental protection areas in Pernambuco, Brazil

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Abstract

This research assessed the relationship between students' perceptions and socioeconomic factors in urban and rural communities surrounding Atlantic rainforest protection areas in Pernambuco, Brazil. We tested whether the utilitarian concept of forests has a determining role in the student community's perception of protected areas. The study was conducted in eight schools in communities surrounding three protected areas, through questionnaires for 410 middle and High school students. The majority of students highlighted the utilitarian importance of forests, but approximately 60% of students did not answer the question regarding the importance of protected areas, displaying a disconnection between perceptions of forests and of protected areas. The students' environmental perception index was significantly different between rural and urban zones, but in both zones, on average, protected areas had a positive utilitarian importance, exclusively related to the protection of nature. Negative aspects of the students' perceptions of protected areas were related to social problems such as lack of law enforcement and land expropriation. Schooling and residence setting had a small (6.7%) but significant influence on student perception. Our results indicate that environmental managers in protected areas need to promote meaningful interaction with student communities from rural and urban settings, to increase the efficiency of these areas and to conserve biological diversity.

Keywords: conservation units; socioeconomic factors; perception index; biodiversity conservation.

Resumo

Esta pesquisa avaliou a relação entre percepção estudantil e fatores socioeconômicos em comunidades urbana e rural do entorno de áreas protegidas de floresta atlântica em Pernambuco, Brasil, visando testar se a hipótese do utilitarismo das florestas tem papel determinante também na percepção da comunidade estudantil sobre as áreas protegidas. A pesquisa foi realizada em oito escolas do entorno de três áreas protegidas do Brasil, através da aplicação de questionário para 410 estudantes do ensino fundamental. A maioria dos estudantes destacou a importância utilitária das florestas, mas cerca de 60% dos estudantes deixaram de responder a questão sobre importância das áreas de proteção, revelando uma desconexão na percepção de importância entre florestas e áreas protegidas. O índice de percepção ambiental estudantil diferiu significativamente entre as zonas rurais e urbanas, mas nas duas zonas, em média, as áreas protegidas têm importância utilitária positiva, relacionadas exclusivamente à proteção da natureza. Os aspectos negativos da percepção estudantil sobre as áreas protegidas foram relacionados a problemas sociais como: ausência de vigilância e desapropriação. Escolaridade e zona de residência apresentaram relação significativa sobre a percepção estudantil, mas explicaram apenas 6,7% da mesma. Nossos resultados apontam que a gestão das áreas protegidas necessita promover ações de interação diferenciadas com a comunidade estudantil da zona rural e urbana, visando aumentar a eficiência destas áreas para conservação da diversidade biológica.

Palavras chave: unidades de conservação, fatores socioeconômicos, índice de percepção, conservação da biodiversidade.

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Introduction

In different regions of the world, protected areas are considered important for the conservation of biological diversity [1, 2] and the provision of benefits and services to surrounding communities [3-5], suggesting that their utility positively influences people's perceptions [6, 7]. The utility of forests and their diversity are also important subjects in early formal schooling [8-12], helping children develop positive perceptions about protected areas.

Some protected areas, however, restrict access to resources. According to Amoah and Wiafe [13], people may develop negative perceptions of restrictive measures and enter illegally to exploit resources, creating conflict with environmental managers, especially where people depend heavily on forest products [14-16]. Such conflicts show that populations surrounding protected areas need special attention, and excluding local residents from wildlife conservation planning weakens legal measures [17-22]. Vodouchê et al. [23] pointed out that people's perceptions can also aid in identifying solutions for problems in nature parks that reflect their education and geographical origin.

Other socio-economic, cultural and environmental factors can also influence the community's perception of protected areas, making them important places for assessing their conservation importance [24, 25]. Ethnobiological studies are particularly useful for revealing the importance of biodiversity in communities and how people use resources from protected areas [3-5, 12, 26-29].

Key socioeconomic factors are: age [14, 23], gender [6, 30], income [31] and education [9, 23, 32], but the weight of each factor can differ between communities due to cultural, family influences [25], and even environmental factors, such as the characteristics of the surrounding landscape [7]. For example, Agbenyega et al. [33] found that because green areas are rarer in urban environments, protected areas are greatly appreciated for their

role in leisure, whether for walking or consuming drugs. Different uses of the space can either negatively or positively influence people's perceptions.

Our study reveals the importance of protected areas for middle and high school students in rural and urban settings and evaluates how environmental and socioeconomic factors can affect students' perceptions. We expected rural students to favor protected areas because their leisure often involves greater interaction with nature and their families usually rely on the land for agriculture and livestock. We set out to answer two questions: 1. Are there differences in students' perceptions of protected areas based on schooling, gender, family income, and residential zones (rural or urban), and which is the most influencing factor? 2. Do the average rural students' perceptions mainly favor protected areas?

Methods

Study area and sampled schools

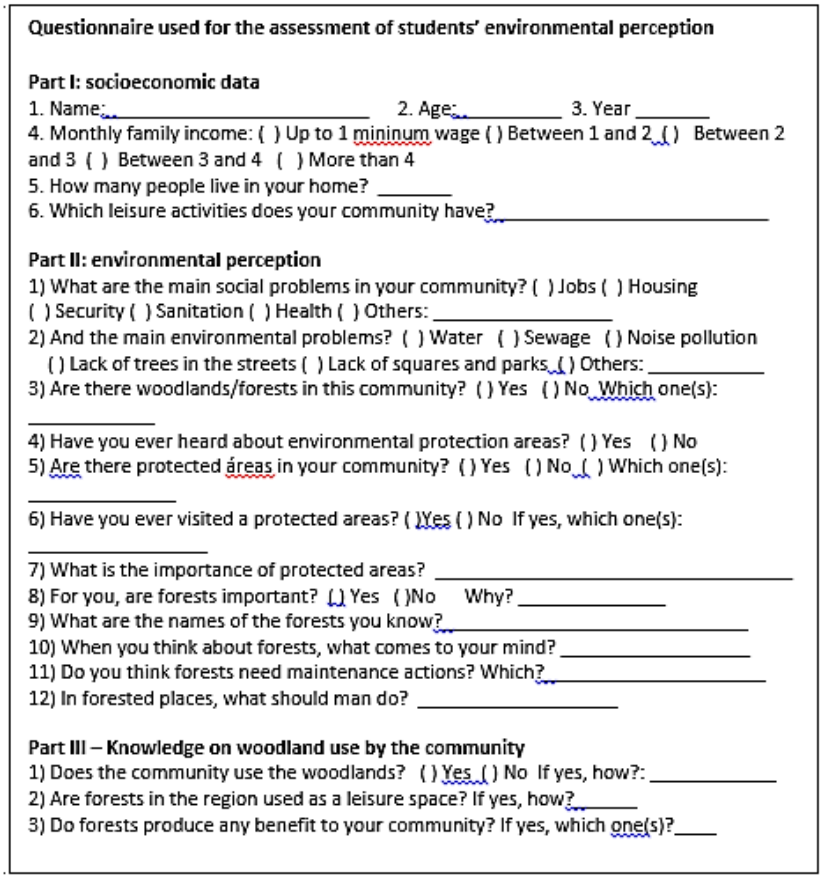
The study was conducted with students in the 6th Year and 9th Year of Middle and High School (Fundamental Schooling in Brazil) in all eight state schools, located around three protected areas in the Metropolitan Region of Recife-Pernambuco, Brazil. The areas were the Atlantic rainforest: Estação Ecológica de Caetés (ESEC Caetés), Refúgio da Vida Silvestre Matas de Gurjáu (RVS Gurjaú), and Floresta Urbana de Jaguarana (FURB Jaguarana). These grades were chosen to participate in this study for two reasons: firstly, Fundamental Schooling is the only level of education offered in the rural areas of Northeastern Brazil, and secondly, these represent the first (6th Year – completely literate) and the last year (9th Year) of Fundamental Schooling, which allows us to assess how education affects students' perceptions of the protected areas.

The ESEC Caetés has 157 ha and is located in an urban setting in the municipality of Paulista, which has 28,000 inhabitants and three state schools serving approximately 2,000 students from the 6th and 9th Year. The RVS Gurjaú has 1,077 ha and is located in a rural setting in the municipality of Cabo de Santo Agostinho. The RVS Gurjaú is surrounded by sugarcane fields and subsistence agriculture. In total, there are 212 families and two state schools serving approximately 300 students from the 6th to the 9th Year. The FURB Jaguarana has 332.2 ha and is located between the municipalities of Paulista and Abreu e Lima. The north side of this protected area (rural zone - known as Sítio São Bento) has approximately 60 families dependent on agriculture and livestock. The São Bento community has one state school, with approximately 250 students from the 6th to the 9th Year. The south side (urban zone) has a large commercial center with a community involved in trade and industry. This area also has two state schools with approximately 1,200 students from the 6th to the 9th Year [34, 35]. All schools have audiovisual resources.

Ethical aspects and Data collection

Initially, the school community was informed about the purpose of the study and the students' parents signed a Form of Informed Consent for their children to participate in research, approved by the National Council of Research Ethics of the Brazilian Ministry

of Health (process: 4245814.0.0000.5207). We then administered a questionnaire with 20 questions, organized into three sections (Fig. 1), to 410 students, 284 from five urban schools setting (6th Year=126; 9th Year=158) and 126 from three rural schools (6th Year=63; 9th Year=63). The number of rural students was lower due to the smaller number of students enrolled in rural schools [34]. The questionnaire was applied at the end of the second semester to ensure that all the syllabus content had already been taught.



Questionnaire used for the assessment of students' environmental perception

Part I: socioeconomic data

1. Name:_____ 2. Age:_____ 3. Year _____
4. Monthly family income: ( ) Up to 1 mininum wage ( ) Between 1 and 2 ( ) Between 2 and 3 ( ) Between 3 and 4 ( ) More than 4
5. How many people live in your home? _____
6. Which leisure activities does your community have?_____

Part II: environmental perception

1) What are the main social problems in your community? ( ) Jobs ( ) Housing ( ) Security ( ) Sanitation ( ) Health ( ) Others: _____
2) And the main environmental problems? ( ) Water ( ) Sewage ( ) Noise pollution ( ) Lack of trees in the streets ( ) Lack of squares and parks ( ) Others: _____
3) Are there woodlands/forests in this community? ( ) Yes ( ) No Which one(s): _____
4) Have you ever heard about environmental protection areas? ( ) Yes ( ) No
5) Are there protected áreas in your community? ( ) Yes ( ) No ( ) Which one(s): _____
6) Have you ever visited a protected areas? ( )Yes ( ) No If yes, which one(s): _____
7) What is the importance of protected areas? _____
8) For you, are forests important? ( ) Yes ( )No Why? _____
9) What are the names of the forests you know?_____
10) When you think about forests, what comes to your mind? _____
11) Do you think forests need maintenance actions? Which?_____
12) In forested places, what should man do? _____

Part III – Knowledge on woodland use by the community

1) Does the community use the woodlands? ( ) Yes ( ) No If yes, how?: _____
2) Are forests in the region used as a leisure space? If yes, how?_____
3) Do forests produce any benefit to your community? If yes, which one(s)?____

Fig. 1. Questions used during interviews with the student community surrounding environmental protection areas in the state of Pernambuco, Brazil

Data analysis

Socioeconomic characterization

Socioeconomic data was described by mean (±standard deviation) and percentages. The income variable was grouped into four categories (up to one minimum wage; between one and two minimum wages; between two and three minimum wages; and above three minimum wages). The relative income was calculated by dividing the medium point of the income category by the number of household residents declared by each student. Differences in age and relative income were assessed by the Mann-Whitney *U* test and Kruskal-Wallis *H* test, respectively.

Environmental perception

The data was tabulated based on the repetition of answers, and the students' environmental perceptions were expressed in percentages. Differences in the number

of citations to the importance of protected areas and forest, and citations to the perceived care and uses of woodlands, were assessed using Kruskal-Wallis tests, with *a posteriori* use of the Student-Newman-Keuls test. An Environmental Perception Index (EPI) was calculated only for students who answered all the questions regarding perception: 86 rural (6^{th} Year=39; 9^{th} Year=47) and 201 urban (6^{th} Year=92; 9^{th} Year=109). The Environmental Perception Index for each student (EPI_i) resulted in a single synthetic numerical variable, reflecting individual perception of the protected areas and the importance of woodlands in their region; this was later used to assess the relationship between socioeconomic factors and the students' perceptions. The calculation of the EPI_i, adapted from Nepal and Spiteri [18] and Karanth and Nepal [37], attributed positive (+1) or negative (-1) points to answers about the importance of forests and protected areas. The difference between the totals of these scores was calculated using the formula: $EPI_i = (np^+) – (np^-)$, where: (np^+)= sum of positive points and (np^-)= sum of negative points.

The scoring of positive and negative perceptions was performed with a conservative approach because formal education influences the students' perceptions, guiding them to think positively about nature and its uses [10]. Scoring was adapted to question type (Fig. 1). In the multiple choice questions, one negative point was scored for each socio-environmental problem cited. Yes/No questions scored one positive point for "yes" or one negative point for "no." Short answer questions were classified into categories before being scored, to avoid over-estimation of positive or negative aspects from any students use of multiple synonyms; one positive point was given for each term that valued nature or its elements and services, and a negative point was given for each term describing activities that were environmentally illegal, predatory, and/or risked the integrity of the individuals and/or the ecosystem. The same answer could therefore score both a positive and a negative point. The average Environmental Perception Index for the student community (EPI_M) on the importance of forests and protected areas was calculated according to the formula: $EPI_M = \Sigma EPI_i / N$, where: EPI_i= individual Environmental Perception Index of each student and N= total number of students.

Relationship between students' environmental perception and socioeconomic factors

We assessed the influence of socioeconomic factors on the Environmental Perception Index (EPI_i) with a multiple linear regression analysis (GLM), considering gender, age, schooling, relative income, and residential zone (rural and urban) as a predictor of variables, some continuous and others categorical, and the Environmental Perception Index (EPI_i) as the continuous response variable. The categorical variables gender, schooling, and residential zone were converted into binary variables (0 or 1) for the model [38]. The statistical analyses were performed in the SPSS program © v. 20 and BioEstat, using a significance level of 0.05.

Results

Socioeconomic characteristics of the student community and students' perception of forests and protected areas

Overall, urban students (n=284) were younger than rural students (n=126). On average, the age of the students in year 6 and 9 in (rural and urban settings) were 11.78±1.16 and 14.36±1.2 years old, respectively, with significant differences between zones independent of the level of education (U=14695.5, p<0.01), as well as within the same school year (6th Year: U=2395, p<0.01; 9th Year: U=8451.5, p<0.01). During the study, the monthly minimum wage in Brazil was US$ 332. Overall, the average relative income was 0.28±0.2 minimum wage, being 0.21±0.1 and 0.32±0.2 in rural and urban zones, respectively, differing significantly (H=33.55, p=0).

Most students (rural: n=117, 92.85%; urban: n=288, 83%) cited the existence of forest in the region, using a total of 15 local names for the Atlantic forest, besides the Amazon rainforest. The existence of protected areas was reported by a low and similar proportion of students in rural zones (46%, n=58) and urban (44%, n=125). Only 38% (n=48) and 26% (n=76) of rural and urban students, respectively, reported that they had visited some protected area (Table 1). A total of 171 and 377 citations of importance for forests was registered in rural and urban zones, respectively, resulting in 13 categories, with the largest number of citations in urban settings, remarkably in the 9th Year, with significant differences (H=10.17, p<0.5) between zones (Table 2).

Table 1. Percentage of the students' knowledge about the existence of forests and protected areas in rural and urban settings of Pernambuco, Brazil (AR= Atlantic rainforest; AMR= Amazon rainforest; NA= did not answer; NK= did not know; (n)= number of students).

		Forests				Protected areas	
		AR (n)	AMR (n)	NA (n)	NK (n)	Knows (n)	Visited (n)
Rural settting	6th Year	29.1 (34)	1.7 (2)	10.3 (12)	11.9 (14)	23.8 (30)	20.6 (26)
	9th Year	27.3 (32)	1.7 (2)	17.9 (21)	-	22.2 (28)	17.4 (22)
	Total	56.4 (66)	3.4 (4)	28.2 (33)	11.9 (14)	46 (58)	38 (48)
Urban setting	6th Year	11.4 (27)	2.1 (5)	12.2 (29)	11.8 (28)	17.2 (49)	7.7 (22)
	9th Year	16.4 (39)	3.9 (9)	13.5 (32)	28.7 (68)	26.8 (76)	19 (54)
	Total	27.8 (66)	6 (14)	25.7 (61)	40.5 (96)	44 (125)	26.7 (76)

In both zones, the students' perceptions highlighted only positive importance to forests, especially for the production of oxygen and wildlife refuges (Table 2). However, the importance of some categories differed between zones. For example, firewood and water sources were at least four times more important in rural environments, while

leisure/wellbeing, scenic beauty, and reduction of pollution were more important in urban environments. In addition, the importance of providing medicinal plants was not perceived in the 6th year of any of the zones and providing wood for construction was not mentioned by urban students or by the 6th year rural. In general, students' perceptions focused on forest's benefits and services, as recorded in the speech: "*they are important because they have medicinal plants, fruits, they produce shade and without them the rivers would dry.*"

Table 2. Total number of citations (n) and percentage of importance of forests and protected areas for students from the 6th and 9th Years in rural and urban settings in Pernambuco, Brazil. Different lower case letters between school years and different capital letters between totals indicate significant differences in Kruskal-Wallis tests at 5% probability.

Categories of importance	**RURAL**			**URBAN**		
	6th Year	**9th Year**	**Total**	**6th Year**	**9th Year**	**Total**
Forest	(n=76)[a]	(n=95)[a]	(n=171)[A]	(n=156)[ab]	(n=221)[b]	(n=377)[B]
Water source	5.3	10.5	8.2	2.6	1.8	2.1
Food source	6.6	6.3	6.4	10.9	5.4	7.7
Oxygen source	21.1	23.2	22.2	16.7	23.5	20.7
Energy (firewood)	2.6	4.2	3.5	0.6	0.5	0.5
Building timber	-	4.2	23.4	-	-	-
Medicinal plants	-	1.1	0.6	-	0.9	0.5
Refuge of fauna	28.9	18.9	23	14.1	17.6	16.2
Refuge of flora	2.6	3.2	2.9	5.1	3.2	4
Microclimate control	3.9	5.3	4.7	5.1	5.9	5.6
Pollution buffer	-	2.1	1.2	5.1	5.9	5.6
Scenic beauty	3.9	2.1	2.9	4.5	5	4.8
Leisure and wellbeing	6.6	3.2	4.7	9.6	9.0	9.3
Earth protection	2.6	2.1	2.3	3.2	2.3	2.7
Did not know	11.8	8.4	9.9	12.8	7.2	9.5
Did not specify	3.9	5.3	4.7	9.6	11.8	10.9
Protected areas	(n=71)[a]	(n=86)[a]	(n=157)[A]	(n=141)[a]	(n=203)[a]	(n=344)[A]
Protection of rivers	4.2	10.5	7.6	6.4	3.9	4.9
Protection of fauna	8.5	11.6	10.2	14.2	11.8	12.8
Protection of flora	7	11.6	9.5	10.6	7.4	8.7
Protection of forests	21	20.9	21	13.5	18.2	16.3
Land expropriation	-	2.3	1.3	-	-	-
Lack of policing	-	-	-	2.1	-	0.87
Did not know	24.0	19.8	21.7	39.7	43.3	41.9
Did not answer	35.1	23.3	28.7	13.5	15.3	14.5

A total of 25.4% of rural students (6th Year=15; 9th Year=17) and 57.7% of the urban students (6th Year=69; 9th Year=95) reported that the woodlands have no use in their community. The others reported diverse uses for forests, with, respectively, 124 and 99 use citations in rural (6th Year=59; 9th Year=65) and urban (6th Year=38; 9th Year=61)

zones. There were significant differences between school years (Fig. 2A) regarding timber, firewood, and garbage dumping, the first two uses cited more by rural students and the last by urban students. It is important to note that drug use and garbage dumping were not cited in forest importance (Table 2). The use of woodlands for leisure was around twice as high in urban settings with varied activities such as: hiking in the woods, playing and swimming in the river, and "playing in the forest edge." In both zones, there were students who did not cite specific uses for the forests, despite indicating that they were used in the community (Fig. 2A).

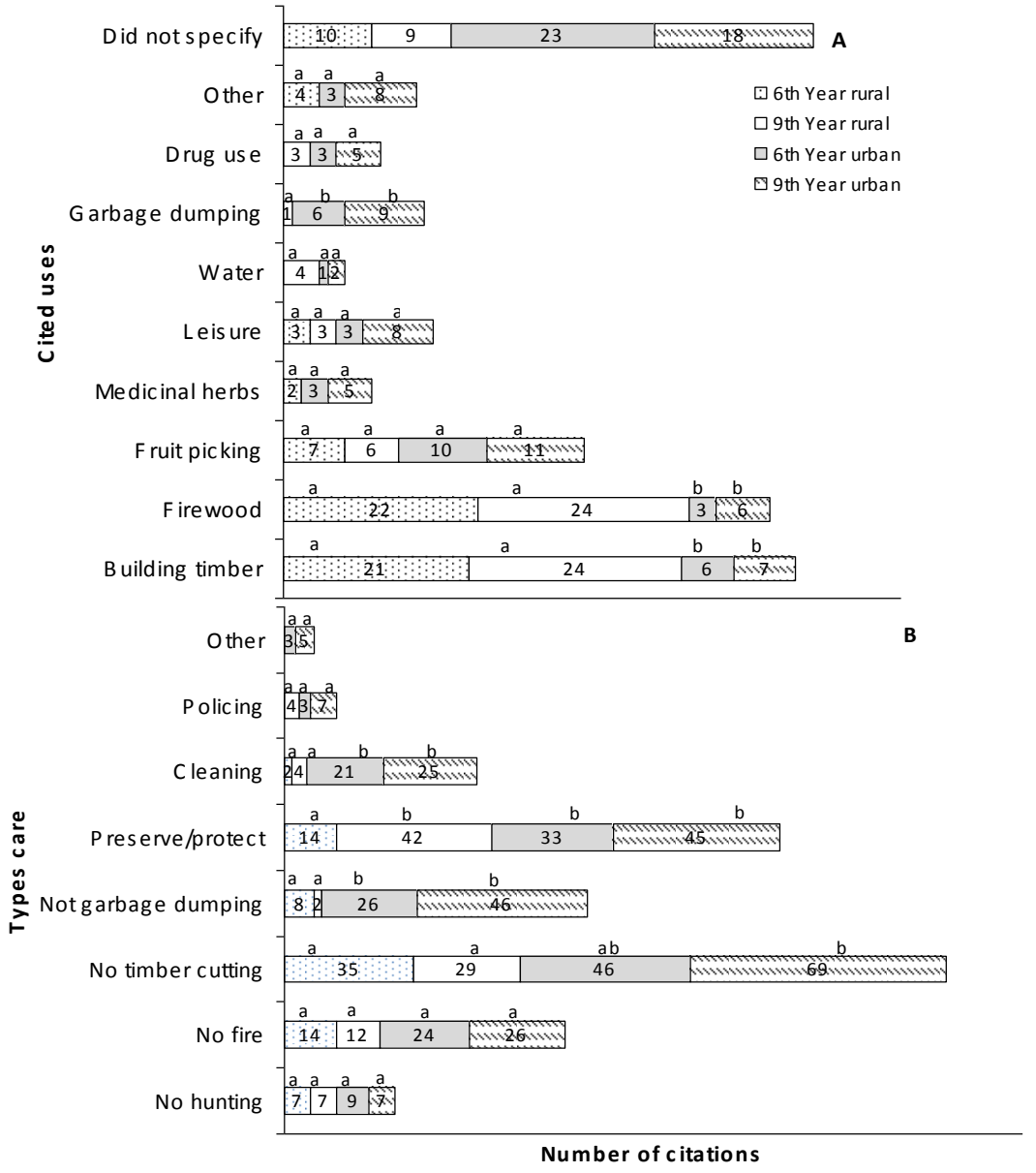


Fig. 2. Students' perceptions of the uses (A) and types of care (B) of the forests in protection areas of Pernambuco, Brazil. Different letters between school years for the same type of use or care indicate significant differences by Kruskal-Wallis tests at 5% probability.

The majority of students (rural=117, 92.85%; urban=242, 85.21%) reported that the woodlands needed care, which were grouped into eight categories, highlighting the need to prevent deforestation and preserve/protect, especially in the urban environment. There were significant differences (Fig. 2B) between grades, regarding care, with prevention of deforestation (no timber cutting), preserve/protect, cleaning up and no garbage dumping cited more in urban zones. Notably, the cleanup and no waste dumping category was mentioned by urban students seven times more than by rural students.

Although students perceived the importance of forests, many did not mention the importance of protected areas or reported that they did not know (Table 2), suggesting ignorance of how protected areas shelter forests. There were 157 and 344 importance citations for protected areas in the rural and urban zones, respectively, resulting in the identification of six importance categories (Table 2), without differences between residential zones or grades (H=7.75, p=0.17).

In the students' perception, the importance of protected areas was related to preservation, with four categories (rivers, fauna, flora, and woodlands); protection of woodlands and fauna were the most mentioned in both zones, and the importance of preserving the rivers cited twice as much by rural students. Students mentioned two categories that highlighted the negative social aspects of land expropriation and lack of law enforcement: "*they take the houses of people and this is bad,*" and "*there are no watch-guards and it is bad because it is too dangerous.*" Expropriation was only mentioned by rural students, and lack of law enforcement only by urban students.

Relationship between environmental perception and socioeconomic factors

On average, the student perception index was positive in both rural (7.05) and urban zones (5.09), but with a significant difference (H=13.75; p<0.01) in individual student perceptions (IPA_i). On average, the IPA_i of school grades was 5.98 (6^{th} Year) and 4.47 (9^{th} Year) in the urban zone and 7.09 (6^{th} Year) and 7.08 (9^{th} Year) in the rural zone, differing significantly only in the urban zone (H=7.29; p<0.01). The multiple linear regression model (GLM) revealed significant positive relationships (ANOVA $F_{5,281}$=4.981, p<0.01) only between the EPI_i and the zone and schooling variables. However, the explanatory power of these variables was just 4.63% for zones and 2.10% for schooling (Table 3).

Discussion

Students' perceptions of forests and protected areas

The students' perceptions reflected the utilitarian importance of forest assets and services in providing human subsistence needs and maintaining wildlife, aligning with perceptions by youth [9, 12, 32] and adults [5, 7, 15, 21] in different parts of the world. Considering formal education encourages students to think about the importance of forests [10, 11], the highlight of utilitarianism was expected. However, while most students recognized the importance of forests, only a few were able to assign importance to protected areas, showing that perhaps protected areas are rarely

discussed in schools, or are discussed in an inappropriate way, preventing students from making the connections themselves because they are still developing their cognitive processes [9]. According to Shobeiri et al. [39] and Caamaño [10], the students partially reflect the environmental consciousness of the teachers, which needs improvement.

Table 3. Coefficients of the multiple linear regression model and explanatory power (R^2) of socioeconomic predicting variables in the individual Environmental Perception Index (EPI_i) of student communities surrounding environmental protection areas in Pernambuco, Brazil.

Predicting variables	**Unstandardized coefficients**	**Standard error**	**Standardized coefficients**	**T test**	**R^2**	***p***
	B		β			
Intercept	7.554	2.214		3.412		0.001
Age	-0.284	0.189	-0.133	-1.507	0.59	0.133
Setting	1.974	0.490	0.246	4.023	4.63	**0.000**
Relative income	0.617	1.057	0.035	0.584	0.11	0.560
Schooling	1.764	0.639	0.239	2.761	2.10	**0.006**
Gender	0.518	0.426	0.070	1.215	0.51	0.226

Many teachers use visual aids to arouse students' interest in biodiversity, but they do not always discuss the threats of local human actions, which causes a disconnect between the syllabus content and the environmental sensitivity of the student, explaining the low percentage in importance of protected areas. Additionally, the record of the Amazon rainforest shows that some students ignore the types of vegetation in the region, perhaps because the exuberance of the Amazon rainforest, as shown in textbooks, is more attention grabbing.

Considering the importance of forests for sustaining life, it is astonishing that people could assign negative values to them. However, conflicts of interest over the type of use can explain this apparent contradiction. For example, parks are protected spaces often used for leisure in England, as reported by Agbenyega et al. [33]. According to these authors, adults who used the park as a leisure space or a shortcut on the way home complained that other people using the park to walk their dogs (leaving feces on the grounds) or to consume drugs negatively affected both their own use of the space and their perception of the importance of the park. Our study found no negative perception of the forests, although some students reported that people dump waste and consumed drugs there.

In addition, legal restrictions on the use of space and resources also induce negative perceptions [22, 29, 37, 40-43]. In our study, the youths' perceptions highlighted positive and negative aspects of protected areas, with differences between zones, such as land expropriation reported only by rural students and lack of policing mentioned only by urban students. Furthermore, wood and firewood were more frequent needs for rural students, while the garbage was a bigger issue for urban students. Even for younger students, the positive and negative aspects of protected areas reflected conflicts of interest in their use and social problems.

In fact, these uses and conflicts allow people to build an "individual concept" of protected areas, manifesting a balance between positive and negative perceptions. This balance represents an average perception that suggests the type of dialogue that environmental managers of protected areas must establish with communities [16, 25, 40, 43]. We found that the average perception by students was positive, highlighting the function of protection, as reported in other studies [40, 44], but by a smaller margin in the urban environment, indicating that urban settings need more attention and, perhaps, that environmental management measures need to be more complex.

Perception versus socioeconomic and environmental factors

Despite the influences of gender [19, 30, 32, 39], income [14, 31], schooling [8, 9, 14, 23] and residential zone [7, 26] on environmental perception, only residential zone and schooling were related to the Environmental Perception Index, albeit with a low explanation power. The influence of education regarding perception has different trends between youth [9] and adults [5, 14, 23, 31]. For adults the trends are: 1. a direct relationship between schooling and perception of forest benefits or conservationist attitudes [14, 23, 31, 43]; 2. an inverse relationship between schooling grade and the perception of forest values or benefits [7]; or 3. a relationship between schooling and dependence on forest resources, with higher dependence corresponding with lesser education [5]. For younger students, perceptions can change with continued education and generally reflect less advanced attention to threats to biodiversity and the importance of protected areas [9] in early school years. In our study, this tendency was only confirmed in the urban environment, which indicated that the relationship between education and environmental perception is not always direct.

According to Grodzinska-Jureczak et al. [8], the environmental sensibility of students depends on their place of residence, and urban students are less likely to have conservationist attitudes. The place of residence was also important in our study, possibly because rural students more often relate to green areas and their parents' use of the land [34]. According to Burger et al. [45] and Davidson and Freudberg [46], parents who work in agriculture and livestock have greater sensitivity to environmental issues, which possibly influences the perception of their children. In the urban environment, student leisure options are diverse and not always related to the environment. Additionally, large urban centers often have sanitation and safety problems, which can negatively affect the students' perceptions, as stated above. Our findings showed that these two variables (residential zone and schooling) can interact, shaping people's perceptions during cognitive development.

Implications for conservation

The positive environmental perception index of the students suggests a promising future for the conservation of biological diversity, because these children will one day make direct use of the woodlands. However, the few answers on protected areas suggest that managers need to improve their relationship with formal education. This can be achieved by involving school authorities, teachers, and students in lectures,

visits to protected areas, environmental scavenger hunts, and other ways to foster connection in the students' perceptions and develop a conservationist culture. Because teachers are key elements in this process we recommend that managers of schools and of protected areas work together to create a permanent teacher training program for environmental educators. Themes such as the importance of the assets and services of protected areas, and their biological diversity, must be discussed in these training programs to foster community awareness of the local and global relevance of biodiversity conservation.

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