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Perception-Based Study on the Value of Nature to People and Land Sparing for Nature in Brazil and Poland

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Abstract: Understanding perception about nature is paramount to understanding human behavior and decision making on the environment. We performed a survey-based study in Brazil and Poland to better understand the perception of land sparing for nature and the perceived value of nature. The countries were selected by intentional sampling and given their importance for local and global biodiversity conservation, and complex socio-ecological context of conservation versus agroforestry business. We performed an online questionnaire (N = 1030) in Brazil and face-to-face interviews in Poland (N = 322). We found that Brazilian respondents demonstrated more pro-environmental attitudes than Polish survey participants. Regarding the question: “How much nature that is left should be spared?”, nearly 51% of Brazilians answered “everything”, compared with 13% of Polish respondents. Just under half of the respondents from Poland (45.6%) indicated that half of the nature that is left should be spared. Brazilian respondents also perceived the intrinsic value of nature to a greater extent compared with Polish respondents; in total, 76% of Brazilians respondents entirely agreed that “Nature, its plants and animals have a value on their own, independent of their usefulness

for us” versus 25% of Polish respondents. Our study contributes to a better understanding of the leverage points driving pro-environmental attitudes in both countries.

Keywords: land sparing; the value of nature; perception-based study

1. Introduction

Understanding the perception of the environment is paramount for implementing on-the-ground initiatives, formulation of environmental policies, and promoting long-term behavior towards sustainability. The importance of understanding the relationship between perception and attitudes is well analyzed in the scientific literature [1]. Environmental problems are often linked to the result of human behavioral choices; hence resolving these problems can, at least partially, be facilitated by understanding and influencing human behavior [2]. There are several questions about what leads to environmental awareness and the willingness to live according to more sustainable choices. The perception is linked to the values of individuals, which are the basis for more specific attitudes and behaviors [3]. Values are a reflection of the experiences lived by each individual, which are influenced by an historical and cultural context [4].

In this study, we investigate the perception of the value of nature in Brazil and Poland. By “nature” we mean “areas containing elements of living systems that include plants and nonhuman animals across a range of scales and degrees of human management, from a small urban park through to relatively “pristine wilderness” [5]. From a social standpoint, Brazilian society has already shown its pro-environmental attitudes [6–10]. In the 2014 Zoological Society of London Global Survey, Brazilian respondents expressed that 60% of Brazilian territory should be protected, representing the highest proportion of respondents of all the countries surveyed [11]. Brazil’s immense natural capital, also expressed in its cultural diversity, provides the conditions for the transformation of conservation and sustainable use of environmental assets into sustainable development opportunities such as protection of pristine areas along with a reduction in poverty and socioeconomic inequity [12–15]. Brazil is the largest country in South America and Latin America, and the fifth-largest country in the world in terms of population and size. Brazil is a developing country with a life expectancy increasing over recent years. Aside from favorable aspects related to country’s development, projected increase in life expectancy means higher demand for environmental resources. According to data from the National Household Sample Survey [16] of 2015, 85% of the Brazilian population lives in urban areas. Regarding the level of education, in 2018, 48% of the Brazilian population over 25 years old was concentrated in levels of education up to complete elementary school; 27% had completed high school; and 16.5%, higher level.

Polish citizens increasingly recognize environmental protection as an important area of state activity. In 2018, 18% of respondents considered that environmental protection belongs to the three areas of the country’s most challenging activity, compared to 7% in 2012 [17]. Public attention in Poland is attracted by such problems as (1) changes in energy production towards climate protection, which is particularly important in the case of Poland with its highly coal-dependent energy sector [18]; (2) heavy air pollution (smog) in residential areas and the resulting health problems of citizens [19,20], as well as (3) the issue of protecting valuable natural ecosystems, particularly noticeable in the case of discussions on logging in one of the last remaining primeval forests in lowland Europe, Białowieża Forest [21,22], a refuge for European bison (*Bison bonasus*), the largest land mammal on the continent [23].

We performed a survey to examine the perceived importance of nature conservation among people in Brazil and Poland. This study has three main objectives: to survey the opinion between Polish and Brazilian residents about (1) the importance of sparing land for nature, (2) identifying principal problems related to the environment, (3) investigating the perception of the value of nature.

Although the question of whether nature should be spared has been investigated previously (e.g., [11]), to our knowledge, this is the first study that asks the public how much of that nature should be spared. Our study was not designed to be representative. Rather, it presents two case studies that we compare. Both approaches were performed according to scientific standards of each method. In both cases, sampling was opportunistic and adjusted to financial and practical limitations of the study. In addition, even though our respondents may not directly be responsible for environmental degradation that may indeed take place indirectly, for instance, via telecoupled consumption. The results of this study could help implement nature conservation and development policies by emphasizing the importance of society's voice in determining appropriate environmental protection priorities and measures.

2. Materials and Methods

2.1. Survey

The study was carried out over 2017 and 2018. In Poland, we conducted 322 face-to-face interviews of students and random respondents in four voivodeships (a highest-level administrative subdivision of Poland): (1) Krakow (the second-biggest city in Poland), Malopolska voivodeship (south/south-east of Poland), (2) Olsztyn (capital of voivodeship), Warminsko–Mazurskie voivodeship (northeast of Poland), (3) Opole (capital of voivodeship), Opolskie voivodeship (south-west of Poland), and (4) Tarnow, a city in Malopolskie voivodeship (south-east of Poland). A table with the percentage of respondents in relation to the cities is found in the Supplementary Materials (Table S1). In Brazil, an online questionnaire was disseminated via social media (Facebook, Instagram) and snowball sampling (N = 1030).

The survey included the following questions:

1. How much nature that is left should be spared? Answer options (single response): Everything (100%); Majority (75%); Half (50%); One-quarter (25%); One-tenth (10%); Nothing (0%) or I don't know.
2. What is the urgency to solve the following environmental problems: air pollution, sea pollution, river pollution, deforestation, climate change, water scarcity, lack of sanitation, species extinction, the use of pesticides, soil erosion? Answer options (single response for each environmental problem): Low; medium; high.
3. Please indicate to what extent you agree with the following statements: (a) Nature, its plants and animals have a value on their own, independent of their usefulness for us. (b) Nature has value only because it brings benefits to humankind. Answer options (single response for each sub-question): Completely agree; Partially agree; Partially disagree; Completely disagree; I don't know.
4. Background questions: age, gender, level of education, and place of residence (for Poland: city >100,000 inhabitants; city <100,000 inhabitants; village/ For Brazil: Rural; Urban)

The results were analyzed in both Polish and Portuguese. The responses were then translated into English. The versions of the questions in Polish and in Portuguese can be found in the Supplementary Materials (Method S1). The interview responses were transcribed into Excel and subsequently transferred to Statistical Package for the Social Sciences (SPSS) and R.

2.2. Statistical Analyses

We used descriptive statistics (performed in SPSS) for all the tables shown in this paper and Tables S3 and S4 (found in Supplementary Materials), which mainly present the frequencies for each answer. We used R software [24] to calculate the correlations between age and gender data and responses regarding the urgency to solve environmental problems for Table S2.

3. Results

3.1. Respondents' Background

Table 1 presents the respondents' background. Most of the Polish respondents were university students, with complete secondary education (84%), and residents of cities > 100,000 inhabitants (63.2%), men (56.7%), and young, i.e., under 30 (73.2%). The Brazilian respondents were mostly women (51%), young (45.4%), residents of urban areas (77.7%), and higher educated (41.6%).

Table 1. Respondents' background.

	Poland	Brazil
Age (Years)		%
<30	73.2	45.4
30–55	2.2	29.0
>55	24.6	6.8
Did not answer		18.7
Gender		%
Male	56.7	32.0
Female	43.3	51.1
Place of living		%
City > 100,000 habitants	63.2	N/A
City < 100,000 habitants	17.8	N/A
Village	19	N/A
Rural	N/A	2.3
Urban	N/A	77.7
Missing	N/A	20
Level of education		%
Primary	0.9	3.0
Secondary	84.1	37.1
Technical	10.3	1.1
Higher	4.7	41.6
None or did not answer	0	17.3

3.2. How Much Nature That Is Left Should Be Spared?

We found a difference between Brazilian and Polish respondents with respect to the question of how much nature that is left should be spared (Table 2). Nearly 13% of Polish respondents indicated “everything” compared with 51% of Brazilians. Just under half of the respondents from Poland (45.5%) indicated that half of the nature that is left now should be spared, compared with only 2.5% of Brazilian respondents. The percentages of respondents in both countries that believed that 50% of nature or more should be spared were similar: in Brazil 85.1% and in Poland, 85.2%.

Table 2. How much nature that is left should be spared? Responses from Brazil and Poland.

	Poland		Brazil	
Percentage of nature that is left that should be spared	N	%	N	%
Everything (100%)	41	12.80	525	51.0
Majority (75%)	95	29.40	326	31.7
Half (50%)	146	45.60	26	2.5
One-quarter (25%)	28	8.80	10	1.0
One-tenth (10%)	6	1.90	2	0.2
Nothing or I don't know or missing	5	1.50	141	13.7
Total	321	100.00	1030	100

Regarding age association (Table 3), we found that most of the older Polish respondents claimed that half of what is left should be spared, while most of the respondents of age under 55 declared it

should be the majority of it. In Brazil, in all age groups, we found that most respondents believed that 100% of nature should be spared (Table 4). For Brazil, the answer had a significantly higher correlation coefficient with age (correlation = -0.19 , $p < 0.01$, $N = 183$). The relation was monotonically inverse, indicating that older people tend to claim that less nature should be preserved.

Table 3. How much nature that is left should be spared—age association. Responses for Poland.

Age of Respondent		How Much Nature Should Be Spared (Poland)?						Total
		Everything (100%)	Majority (75%)	Half (50%)	One-Quarter (25%)	One-Tenth (10%)	I Don't Know or Nothing	
<30	<i>n</i>	39	88	86	11	6	4	234
	%	16.70%	37.60%	36.80%	4.70%	2.60%	1.70%	100%
30–55	<i>n</i>	1	4	1	0	0	1	7
	%	14.30%	57.10%	14.30%	0.00%	0.00%	14.30%	100%
>55	<i>n</i>	1	2	59	17	0	0	79
	%	1.30%	2.50%	74.70%	21.50%	0.00%	0.00%	100%
Total	<i>n</i>	41	94	146	28	6	5	320
	%	12.80%	29.40%	45.60%	8.80%	1.90%	1.50%	100%

Table 4. How much nature that is left should be spared—age association. Responses for Brazil.

Age of Respondent		How Much Nature That Is Left Should Be Spared (Brazil)?							Total
		Everything (100%)	Majority (75%)	Half (50%)	One-Quarter (25%)	One-Tenth (10%)	I Don't Know (0%)	Missing	
<30	<i>n</i>	265	181	14	6	0	0	2	468
	%	56.62%	38.68%	2.99%	1.28%	0.00%	0.00%	0.43%	100%
30–55	<i>n</i>	193	93	8	2	1	0	2	299
	%	64.55%	31.10%	2.68%	0.67%	0.33%	0.00%	0.67%	100%
>55	<i>n</i>	34	33	1	0	1	0	1	70
	%	48.57%	47.14%	1.43%	0.00%	1.43%	0.00%	1.43%	100%
Missing	<i>n</i>	33	19	3	2	0	0	136	193
	%	17.10%	9.84%	1.55%	1.04%	0.00%	0.00%	70.47%	100.0%
Total	<i>n</i>	525	326	26	10	2	0	141	1030
	%	50.97%	31.65%	2.52%	0.97%	0.19%	0.00%	13.69%	100%

3.3. The Urgency to Solve Environmental Problems

Concerning the urgency to solve environmental problems (Table 5), the respondents from Poland indicated as the most urgent problems “water scarcity”, “air pollution”, and “river pollution”. According to Brazilian respondents, the most urgent problems were “river pollution”, “deforestation”, and “lack of sanitation”. For both Polish and Brazilian respondents, the least urgent environmental problem was “soil erosion”.

In the correlation of responses with age and gender data (Table S2), we found that in Brazil, as age increased, the higher the tendency for Brazilian men to think that soil erosion (34%) had high urgency. There was also an influence on the increase in age for pesticides (28%), deforestation (28%), and lack of sanitation (24%). Regarding Brazilian women, there was a correlation between increasing age when considering pesticides (19%) as having high urgency. In relation to Polish men, a correlation was found between younger respondents who found air pollution (69%), river pollution (56%), species extinction (53%), sea pollution (49%), and soil erosion (45%) as having high urgency. Regarding Polish women, the younger the respondent, the higher the chance for them to find soil erosion (68%), sea pollution (58%), river pollution (58%), air pollution (38%), and deforestation (37%) as having high urgency.

Table 5. Level of urgency to solve environmental problems.

Environmental Problem	Urgency % (n)		
	Low	Medium	High
POLAND			
Air pollution	9.3 (30)	38.8 (125)	51.9 (167)
Sea pollution	20.8 (67)	48.8 (156)	30.7 (99)
River pollution	16.1 (52)	32.6 (105)	51.2 (185)
Deforestation	24.5 (79)	49.1 (158)	26.4 (85)
Climate change	25.0 (80)	42.2 (135)	32.8 (105)
Water scarcity	10.2 (33)	35.4 (114)	54.3 (175)
Lack of sanitation	9.3 (30)	49.1 (158)	41.6 (134)
Species extinction	25.2 (81)	36.4 (117)	38.3 (123)
The use of pesticides	25.8 (83)	43.3 (139)	30.8 (99)
Soil erosion	33.9 (109)	56.2 (181)	9.9 (32)
BRAZIL			
	Low	Medium	High
Air pollution	1.76% (18)	21.46% (220)	76.78% (787)
Sea pollution	0.78% (8)	12.29% (126)	86.93% (891)
River pollution	0.59% (6)	5.37% (55)	94.05% (964)
Deforestation	0.68% (7)	9.16% (94)	90.16% (925)
Climate change	7.02% (72)	25.34% (260)	67.64% (694)
Water scarcity	1.85% (19)	14.72% (151)	83.43% (856)
Lack of sanitation	1.36% (14)	11.01% (113)	87.62% (899)
Species extinction	3.61% (37)	21.95% (225)	74.44% (763)
The use of pesticides	4.78% (49)	19.71% (202)	75.51% (774)
Soil erosion	5.37% (55)	33.85% (347)	60.78% (623)

3.4. The Value of Nature to People

We found a difference in the perception of the value of nature between the respondents from both countries (Table 6). In Brazil, respondents perceived the intrinsic value of nature to a greater extent than those in Poland. In Poland, younger respondents were more likely than older ones to consider that nature has value in itself. In terms of gender, our results showed that more women than men perceived the intrinsic value of nature. We also observed that in Poland, residents of smaller cities or villages perceived the value of nature to a greater extent than residents of larger cities.

Table 6. Percentage of agreement with the sentences on the value of nature.

Poland	Completely Agree	Partially Agree	Partially Disagree	Completely Disagree	I Don't Know	
Nature, its plants and animals have a value on their own, independent of their usefulness for us.	24.9% (80)	39.6% (127)	30.2% (97)	4.4% (14)	0.9% (3)	
Nature has a value only because it brings benefits to humankind.	5% (16)	22.1% (71)	42.4% (136)	28.3% (91)	2.2% (7)	
Brazil	Completely agree	Partially agree	Partially disagree	Completely disagree	I don't know	Missing
Nature, its plants and animals have a value on their own, independent of their usefulness for us.	75.9% (782)	7.6% (78)	1.1% (11)	1.4% (14)	0.6% (6)	13.5% (139)
Nature has a value only because it brings benefits to humankind.	6.7% (69)	6.0% (62)	12.1% (125)	60.5% (623)	1.4% (14)	13.3% (137)

In Brazil, women were more likely to express that “Nature, its plants and animals have value in themselves, regardless of whether they are useful to us” ($r_s = 0.088, p < 0.01$) and to disagree that “Nature has value only because it benefits humanity” ($r_s = -0.138, p < 0.01$). The more educated the respondent, the less likely he or she was to agree that “Nature has value only because it benefits humanity” ($r_s = -0.122, p < 0.01$). There were also correlations between the way respondents perceived nature’s value. There was a positive correlation between agreeing that “Nature brings benefits to humanity” and “Nature, its plants and animals have value in themselves, regardless of whether they are useful to us” ($r_s = 0.190, p < 0.01$). Finally, there was a negative correlation between agreeing that

“Nature, its plants and animals have value in themselves, regardless of whether they are useful to us” and “Nature has value only because it benefits humanity” ($r_s = -0.214$, $p < 0.01$).

In Poland, there was a small tendency for women to agree more than men with the intrinsic value of nature (Table S3). In relation to the agreement with the utilitarian value of nature, we found that, in Poland, there was a greater tendency among men of secondary and technical level, and among women of primary and higher education level (Table S4).

4. Discussion

The importance of the public perception of nature for decision making cannot be underestimated. It drives behavior, individual choices, trade, and political agendas. To our knowledge, our study is the first to seek the opinion of the opportunistically selected public about how much of the remaining nature should be spared, environmental problems, and the value of ecosystem services. We found a strong and consistent tendency towards a pro-environmental attitude among Brazilian respondents compared with people from other countries, in this instance, Poland. Our results confirmed those of Kümpel [11], who revealed Brazil as one of the most pro-environmental countries of seven countries surveyed (Australia, UK, Brazil, USA, China, India, and South Africa), at least in terms of the perceived importance of nature. The results showed that Brazilian respondents considered that 60% of Brazilian territory should be protected [11].

Holmes et al. (2017) [25] used questionnaires to empirically examine opinions on the “new conservation” held by attendees at the 2015 International Congress for Conservation Biology. Results showed differences between the debate on the new conservation in the literature and views held within a wider, but still limited, conservation community and demonstrated the existence of at least one viewpoint (in favor of conservation to benefit people but opposed to links with capitalism and corporations). This study originated “The Future of Conservation” (FoC) survey, which comprised an online questionnaire that placed the participant’s position on two axes: whether their opinions were people- or nature-centered and whether they were pro- or anti-market, i.e., their scepticism about the role of markets, corporations, and capitalism for conservation. Using the FoC, [26] survey they characterized the views of 9264 conservationists from 149 countries, identifying specific areas of consensus and disagreement, and three independent dimensions of conservation thinking. The first two dimensions (people-centered conservation and science-led ecocentrism) have widespread support, whereas conservation through capitalism is more contentious. The authors highlighted relationships between dimension scores and respondents’ gender, age, educational background, career stage, and the continent of nationality. The gender result of the FoC survey could be linked to the higher average levels of empathy for the well-being of other humans among women than men. Similarly, our results show that both in Brazil and in Poland, women were more likely to recognize the intrinsic value of nature.

The Brazilian respondents perceived river pollution as the most urgent environmental issue to be solved (94%), representing problems that affect people’s lives explicitly, including in urban areas where most respondents are. Some recent events may help to explain this result. In 2014 and 2015, much attention was given to the biggest water crisis in the state of São Paulo, the most populous state in the country. The crisis was related to poor management of the supply system in an atypical rain regime in the summer of 2014, well below historical averages, and the high temperatures that led to increased consumption [27]. Some studies endorse the hypothesis that deforestation in the Amazon is also one of the factors behind the lack of water in São Paulo [28,29]. In addition, two recent accidents in mines (2015 and 2019) are considered the worst environmental disasters that occurred in Brazil [30]. The first one resulted in the death of 19 people and rendered more than 300 families homeless. Thousands of tons of iron ore tailings were carried into the Doce River basin, reaching the Atlantic coast near the mouth of the river. The second one, at an iron ore mine, caused the disappearance of about 300 people. The northern region of the country, the birthplace of the Amazon, is the worst region in the country in terms of sewage collection and treatment. Thus, cities that bathe in Amazonian rivers dump sewage

directly into rivers. A study carried out in 2019 shows that only 6.5% of Brazilian rivers have good water quality and that a large part of the country's watercourses is slowly losing the capacity to supply the population and even to harbor aquatic beings [31].

The second most urgent issue to be solved is deforestation (90%). Deforestation of the Brazilian Amazon is not only recognized as a national challenge but also internationally. Deforestation has always been a complex problem in Brazil due to its direct association with agriculture [32], one of the core economic activities. Lack of sanitation was the third-highest priority issue identified by Brazilian respondents. Only 53.2% of the Brazilian population have sewage collection, 46.3% have treated sewage, and 83.6% have access to treated water [33]. The northern region, where the largest indigenous population in the country is located, is the one that least offers basic sanitation to the population. Until 2009, only 63.07% of the indigenous population in Brazil had access to treated water [34]. The situation is also alarming in slums and irregular areas in large cities across the country, where the poorest urban populations live. In the first three months of this year alone, the lack of sanitation has generated more than 40,000 hospitalizations in Brazil [35]. Even though this problem is identified by the population, it historically has not attracted the attention of decision-makers to be treated as a priority due to its "invisibility", resulting in low investment in the sector.

In Poland, water scarcity was pointed out by 54% of respondents as the most urgent issue to be solved. Poland is referred to as the "European Sahara" as it is one of the countries in Europe with the least available water per capita [36]. The capacity of storage reservoirs in Poland is minimal, and water shortages are predicted to occur with more frequency in the future. Besides, 52% of Polish respondents identified air pollution as an urgent issue, likely related to repeated events of smog in the country [37]. The issue of air pollution was also ranked highest (62%) in the survey on ecological awareness in Poland, in which the respondents were asked to indicate the three most urgent environmental problems [17].

In Poland, soil erosion is the least perceived problem. This result confirms that the importance of soils is generally overlooked and underestimated [38], and its role in human life and in the conservation of biodiversity is not properly recognized [39]. Issues around soil conservation have been neglected [40], and the consequence is continued degradation through erosion, pollution, landslides, and silting up watercourses. Given the land scarcity and possible future food shortages, soil conservation calls for action [41,42]. This result confirms that there must be greater awareness of its importance. However, interestingly, in the correlation of responses with age and gender, we found that among younger Polish women and men there was a higher likelihood of finding soil erosion a high urgency issue.

The intrinsic value of nature was perceived to a higher extent by Brazilian than by Polish respondents, with 76% of Brazilian respondents entirely agreeing with the statement "Nature, its plants and animals have a value on their own, independent of their usefulness for us". In case of Poland, the survey results show that Polish respondents recognize to a lesser extent than Brazilian respondents the intrinsic value of nature—24.9% entirely and 39.6% partially agreed that "Nature, its plants and animals have value in themselves, regardless of whether they are useful to us". For comparison, in the survey for the Polish Ministry of Environment, 35% of respondents in Poland indicated that nature has value on its own and it is one of two main reasons for nature protection, more important being health protection (64%) and the concern over the next generations (51%) [17]. Values are related to environmentalism [3], but the sociocultural variation of values has not been explored enough in the literature [3]. Our study therefore complements the existing body of knowledge on perception of the value of nature in different countries and different contexts. Following other researchers [3], we highlight the importance of these types of studies for decision making as more research is needed to understand how value perception influences behavior and to improve methods for implementing values in collective decision making.

5. Conclusions

Studies on environmental perception are crucial for efficient decision making. To our knowledge, this is the first study to have examined public opinion about how much of the nature that remains

should be spared. Our case study reveals interesting differences in the responses of the public from two economically and socioculturally dissimilar countries. We found that Brazilian respondents demonstrated more concerns related to the environment than Polish survey participants. This may be related to different relationships with nature and recent broad and impactful environmental problems in the country. The analysis of the perception of urgency about environmental problems also indicated relationships with recent disasters and circumstances in both countries, which provides an additional message to decision-makers regarding the impact of these events and priority to solve them. Perception drives behavior, and behavior influences decision making not only at household level but also policy-making choices, and understanding society views is paramount for directing the future path towards sustainability. The results of this study are therefore important for the emerging discussion on how much nature societies are willing to protect and what might be future focal points for action and environmental education. We also believe that the results of this study, by complementing the existing body of knowledge, could help guiding nature conservation and development policies.

Supplementary Materials: The following are available online at <http://www.mdpi.com/2071-1050/12/21/8860/s1>, Table S1: Percentage of respondents in relation to Polish cities, Method S1: Questions of the survey in Portuguese and in Polish, Table S2: Correlations between age and gender data and responses regarding the urgency to solve environmental problems Regarding age and urgency (R software), Table S3: Cross-tabulation - Level of agreement with the statement 'Nature, its plants and animals have a value on their own, independent of their usefulness for us' with gender and education level, Table S4: Cross-tabulation - Level of agreement with the statement 'Nature has a value only because it brings benefits to humankind' with gender and education level.

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