



## Influence of the socio-spatial context on the perception of environmental problems in cities in Spain and Argentina

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### ARTICLE INFO

Handling editor: Jun Bi

#### Keywords:

Blind attitude  
Emmetropic attitude  
Environmental awareness  
Hierarchical clustering  
Socio-ecological systems

### ABSTRACT

Frequently, the relationship between humans and the rest of the biosphere led to environmental problems. The social perception of these problems, their impacts and their spatial scale (local or global) is a necessary line of research for the well-being of society and environmental conservation. To analyse social perception, a survey was carried out in capital and non-capital cities in Argentina and Spain. This study proposes novel attitudes (forms of perception) that have not been studied so far. These are: blind (no perception of the problem), myopic (local perception) and emmetropic (local and global perception), together with the previously studied hyperopic attitude (global perception). Results showed the perception of specific problems related to pollution, deforestation, global change, and discharges, among others. There was a predominantly emmetropic perception, highlighting a hyperopic attitude towards deforestation, with no perception of some problems. In Argentina, as in capital cities (densely populated areas), myopic attitudes predominated, with fewer problems perceived than in Spain or in non-capital cities (areas with lower population density), where emmetropic and hyperopic attitudes predominated. The results did not show similar attitudes between the two countries studied, and spatial proximity did not influence environmental perception. Less densely populated areas showed greater specific concern about agricultural and pollution problems, while more densely populated areas perceived general problems such as global change. Future studies on environmental perception, which delve deeper into the society-biosphere relationship, are essential to develop environmental awareness policies aimed at effectively mitigating the impacts of environmental problems.

### 1. Introduction

At present, there is a remarkable acceleration of different socio-economic processes that are affecting the functioning of the planet. This acceleration is generating environmental change on a global scale resulting from the imbalance between the society-rest of the biosphere interrelationship (Rockström et al., 2009). The Sustainable Development Goals (SDGs) and the 2030 Agenda constitute a call for society's engagement for action to protect the planet and improve people's quality of life (Biermann et al., 2017). Specifically, knowledge of environmental education and awareness of environmental issues among the

urban population can contribute to achieving highly relevant targets for SDGs such as target 7 of SDG 4 (quality education) and targets 3, 4 and 6, among others, of SDG 11 (sustainable cities and communities). It is assumed that human activities are directly linked to environmental problems and, therefore, it is necessary to investigate the environmental perceptions associated with actions in response to some change in the environment (Lozano et al., 2016).

We identified, through surveys in different cities of Argentina and Spain, the perception of environmental problems that population indicated as the most relevant. Through the comparative analysis, the environmental problems were analysed considering the interrelation

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<https://doi.org/10.1016/j.jclepro.2023.138882>

Received 15 March 2023; Received in revised form 30 June 2023; Accepted 14 September 2023

Available online 26 September 2023

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with their socio-demographic and spatial context. For this purpose, different attitudes related to the respondents' environmental perception were considered, with emphasis on the phenomenon of environmental hyperopia, contrasting it with other defined attitudes (i.e. blind attitude, no perception of the problem; myopia, local perception; and emmetropic attitude, local and global perception). Taking into account previous researches, we consider that the analysis of environmental perception is a source of relevant information for decision-making and should be incorporated into public policies related to the environment (Zube, 1999; Rajapaksa et al., 2018). The socio-demographic context has a direct impact on the lines of action, which should be defined at different scales (global, regional, and local). Based on the hypothesis on the bias of the socio-spatial context in the environmental perception of citizens, where the inhabitants of capital cities identify problems with a broader vision while in cities of lower hierarchy the perception of problems that affect them more directly predominates, this study focused on studying social perception of environmental problems from a geographical (spatial) approach. Thus, the specific objectives were: (a) to identify the existence of environmental problems with greater relevance in citizen perception; (b) to explain the interrelation of environmental problems identified with the attitudes and locations studied, evaluating environmental hyperopia as an attitude in the citizens perceptions, contrasting with other attitudes (i.e. blind, myopia and emmetropic); and (c) to analyse the similarities and differences between locations at different levels through the implementation of an Hierarchical Classification algorithm: international, political-administrative and dimensional scales.

## 2. Literature review

Human perception has been subject of study since the mid-20th century, understood as a cognitive process of consciousness that consists in the recognition, interpretation, and the elaboration of judgments about the sensations obtained from the environment (Vargas Melgarejo, 1994; Dalton et al., 2015). In recent years, there has been increasing interest in the relationship between humans and their environment, understanding environmental perception as a tool for understanding certain aspects of the experience that people construct in relation to the environment or, as defined by Zube (1999), awareness or feelings about the environment. If this environment presents an anomalous situation that affects both the ecological values recognised in a locality or region and the quality of human life, it is understood that there is an environmental problem that must be perceived by society, scholars and administrations, in order to act by providing the relevant means and tools to mitigate its effects that can disrupt human well-being (Lozano et al., 2016).

Previous studies have shown that individuals consider that environmental problems are more likely to occur elsewhere (away from their own environment) and with consequences for other people (Uzzell, 2000). Similarly, citizens are more concerned about global environmental problems that they perceive as serious, even if they occur far away from their own environment and over which they have limited influence. They also tend to consider local problems less important, despite having the possibility of taking concrete action on them (Cabezas-Cáceres et al., 2018). It is important to highlight that, under the framework of environmental hyperopia, people generally feel helpless to solve global environmental problems (MacDonald et al., 2015). Thus, they perceive environmental problems far from their surroundings more clearly than those affecting their local environment and themselves (Lima and Castro, 2005; Schultz, 2014). In environmental psychology, this unrealistic perception has been termed "environmental hyper-optimism" (Uzzell, 2000) and, more recently, "spatial optimism" (Hatfield and Job, 2001; Pahl et al., 2005; Gifford, 2014). According to Schultz (2014), this type of rather generalized perception can function as a barrier for individuals to address local environmental problems.

It has been observed that environmental campaign designs aimed at behavioral change tend to focus primarily on individual behaviors at the

global scale, while strategies driven by governments are considered more relevant at the local level (MacDonald et al., 2015). Inhabitants have the capacity to change their behavior towards more sustainable practices, generating a cumulative and collective impact at the local level. However, public policies involve local actors in the search for solutions. Otherwise, there is a greater risk that public awareness of local problems will diminish and less action will be taken (Allen et al., 2001). In addition, several studies indicate that, to understand the environmental perception of local stakeholders, the different ages, occupations and professions of the population must be taken into account and that, to address specific environmental problems, it is necessary to carry out diagnoses focused on demographic factors (Sales et al., 2023). In this context, research on environmental perception related to socio-economic and environmental aspects of people's locations has been largely under-researched (García-Mira et al., 2005; Lee et al., 2015).

## 3. Methods

### 3.1. Study areas

This research is based on surveys carried out in four cities in two countries: Buenos Aires and Mendoza in Argentina, and Madrid and Almería in Spain (Fig. 1). In Argentina, Buenos Aires has a projected population of 16.00 million (M) inhabitants (3.00 M in the Autonomous City and 13.00 M in its urban agglomerate, Greater Buenos Aires) while the city of Mendoza has 2.00 M inhabitants (INDEC, 2015). In Spain, Madrid has a population of just over 3.00 M, with the entire Community of Madrid reaching almost 7.00 M, while Almería has just under 1.00 M inhabitants (EUROSTAT, 2015). In terms of population density, Madrid has 650 inhabitants/km<sup>2</sup>, Almería 673.3 inhabitants/km<sup>2</sup> (EUROSTAT, 2015), Mendoza 11.7 inhabitants/km<sup>2</sup> and Buenos Aires 51.2 inhabitants/km<sup>2</sup> (INDEC, 2015). Although the total populations of Argentina and Spain are similar (45.00 and 47.00 M respectively), Spain's Gross Domestic Product (GDP) per capita (€26,000) is 66% higher than Argentina's (€8200) (World Bank, 2021). In this sense, the GDPs of Spanish cities (€35,000 in Madrid and €20,000 in Almería) are higher than the GDPs of cities in Argentina (€25,000 in Buenos Aires and €8500 in Mendoza) (World Bank, 2021).

Buenos Aires has a humid temperate climate (i.e. average temperature of 17.3 °C and 1112 mm of annual rainfall), while Mendoza is part of the drylands with arid climates (i.e. 16.3 °C and 492 mm). Almost 40% of Argentina's urban population is concentrated in Buenos Aires, where more than 90% of the population is urban and is concentrated in less than 5% of the province's surface area (INDEC, 2015). More general environmental problems are pollution, noise, and traffic congestion (Velázquez and Celemín, 2013). In Mendoza, approximately 81% of population is in urban areas (INDEC, 2015). The urban sprawl that is also occurring (especially in the Mendoza Metropolitan Area) on the foothills have marked effects on the maximisation of alluvial and desertification risks (Abraham and Salomón, 2011).

Madrid has a continental Mediterranean climate (i.e. 14.5 °C and 415 mm of annual rainfall), and Almería has a semi-arid climate (i.e. 17.4 °C) with rainfall falling to less than 150 mm, making it the driest region in Europe (González-García et al., 2021). The population distribution indicates Madrid's markedly urban character with only 3% rural population (EUROSTAT, 2015).

### 3.2. Data collection: sample design and survey implementation

Surveys were carried out during six months (years 2021–2022), based on a combination of biased, closed (dichotomous or multiple choice) and open-ended questions, in which respondents could express and rate the environmental issues they considered most relevant (see Appendix A). A total of 50 random on-site pilot surveys were conducted in the study areas. To reach the widest possible range of settings and

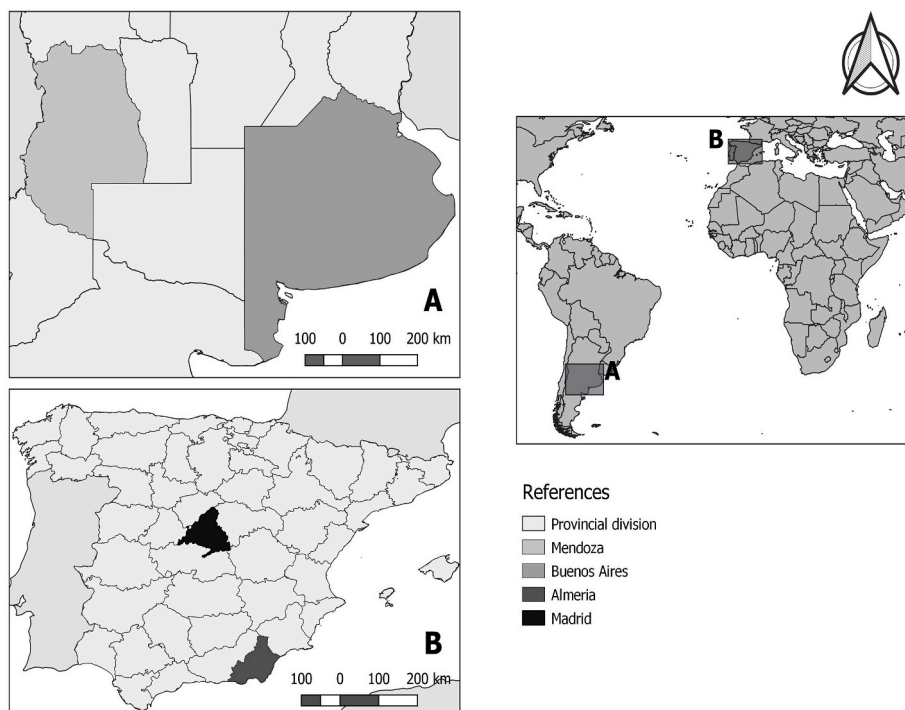


Fig. 1. Location of the study areas: A) Argentina; B) Spain.

enlarge the sample size, online surveys were implemented, getting a total of  $n = 517$  applicable surveys. In this sense, a stratified sampling was carried out to locate respondents in order to cover the widest possible socio-economic spectrum (different neighbourhoods, rural and urban areas), the widest possible age range (18–30; 31–45 and >46 years) and different genders (i.e. male, female and other). Many surveys were carried out in educational centres considering different levels of education (secondary and university) and with different educational profiles (social sciences, environmental, economics, among others), being spread relatively evenly across the different cities (Fig. 2).

### 3.3. Data management

Answers of surveys were grouped into three comparative levels: 1)

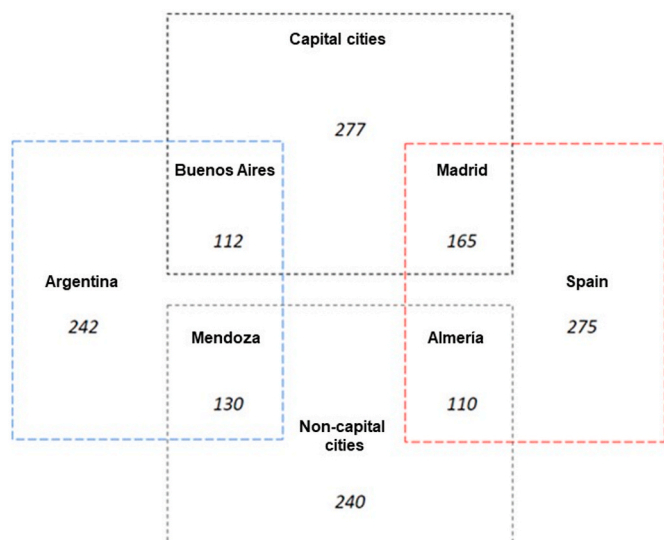


Fig. 2. Distribution of the total number of surveys conducted by countries and capital and non-capital cities covered.

international (Argentina, Spain), 2) political-administrative function (capital cities - Buenos Aires and Madrid - and non-capital cities - Mendoza and Almeria) and 3) dimensional (i.e. cities) (Buenos Aires, Mendoza, Madrid, Almeria). Through the survey implemented (Appendix A), the environmental problems most perceived by the population were detected. The problems considered most relevant were those that exceeded a threshold defined as 50% of the maximum number of mentions in each case. An analysis of the perception of the influence of environmental problems was incorporated by considering four mutually exclusive attitudes based on the concept of environmental hyperopia (Uzzell, 2000; García-Mira et al., 2005). In contrast to this concept, the concept (attitude) of environmental myopia was introduced as a novelty. In the same way, we have also incorporated two other attitudes, emmetropia and blindness, which have not been reported so far in similar studies on human perception of environmental problems (Table 1).

Relevant problems were counted, comparing the coincidence in relevance or non-relevance for the different analysis levels. The attitude of the respondents was ranked in each case on each problem and the percentage frequencies of attitudes were calculated for all of them (Fig. 3).

Table 1

Defined attitudes of the respondents in relation to the spatial perception of environmental problems.

Blind	The blind attitude occurs when environmental problems are not perceived as relevant, without differentiating the distance between the respondent and the environment.
Myopic	The myopic attitude occurs when environmental problems are perceived as relevant only at a close (local) distance. The problem only affects the respondent.
Hyperopic	The hyperopic attitude occurs when environmental problems are perceived as relevant only at a long distance (national or global). The problem only affects the global population.
Emmetropic	The emmetropic attitude occurs when environmental problems are perceived as relevant at near (local) and far (national or global) distances. The problem affects the respondent and the global population.

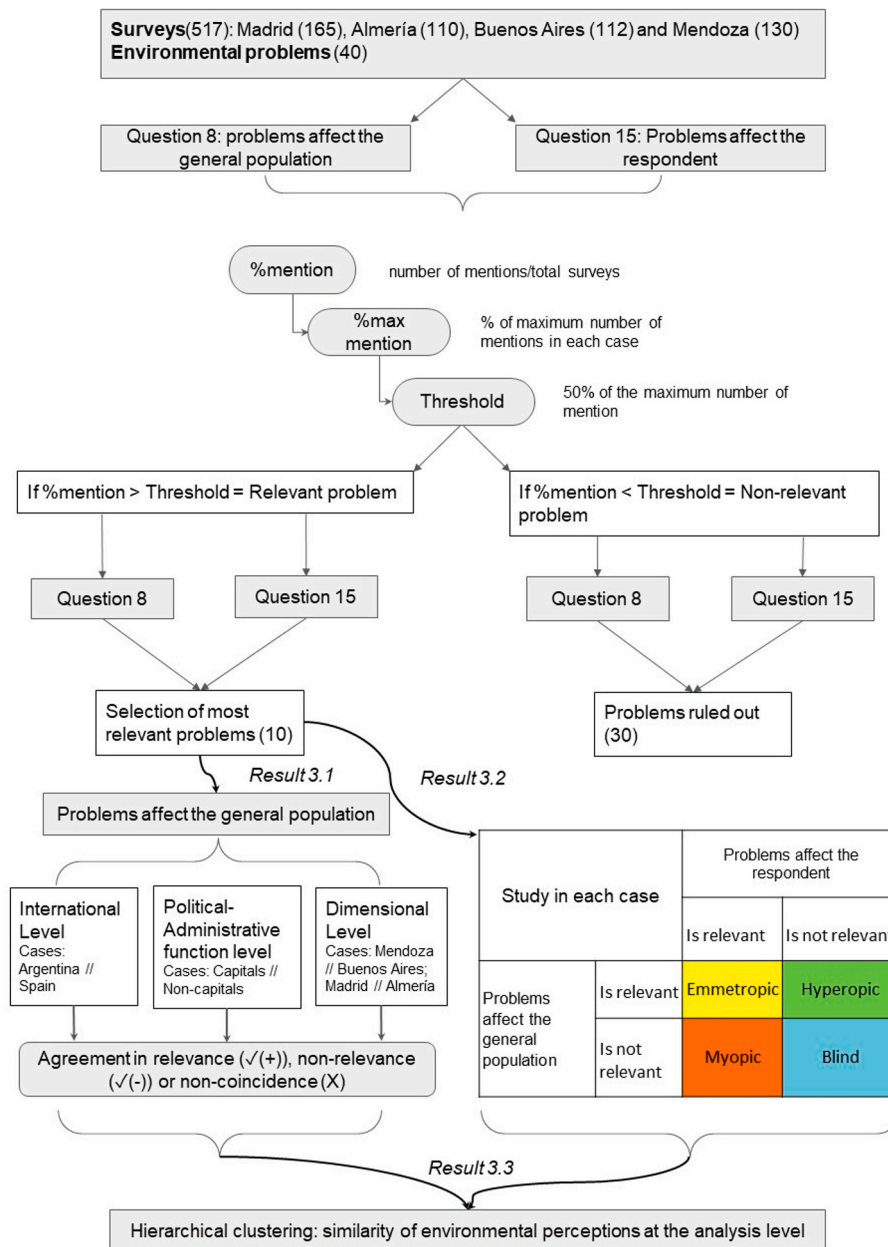


Fig. 3. General outline of the structure of the article.

### 3.4. Statistical analysis

Data were analysed considering the levels set out in Fig. 3. A Multiple Correspondence Analysis (MCA) was applied to generate a cluster for the environmental problems under consideration using SPSS software (IBM SPSS, 2012). The mentions of the data table obtained from the surveys carried out allowed the results to be grouped spatially according to the attitude evidenced by the respondents (Audigier et al., 2017). A Hierarchical Classification algorithm (i.e. Cluster) was run on the set of environmental problems (Kosmopoulos et al., 2015). In this way, these problems were identified and grouped by similarities according to the levels of analysis described above and according to the environmental attitudes (i.e. spatial scale used). A clustering method based on Ward's criterion, a procedure where the criterion for the choice of the pair of clusters to be mixed in each step is based on the optimal value of an objective function (Młodak, 2021), together with the consideration of a minimum squared Euclidean distance of 5 as the estimation threshold for the generation of clusters (Murtagh and Legendre, 2014), was used to

perform the hierarchical classification. Based on the dendrogram obtained, a mean comparison test was carried out to compare the values of the environmental problems between clusters, thus identifying the attitude of each group towards the global behaviour of each variable through the comparison of the respective averages (White and Thomas, 2005).

## 4. Results

### 4.1. The most relevant environmental problems for respondents

The problems mentioned by respondents were 40, of which 10 were relevant (exceeding the threshold of 50% of the maximum number of mentions) at all comparative levels of analysis (Table 2). Considering all case comparisons (countries, clustered capitals and cities) there is agreement on the relevance of only two issues: global change; and deforestation. For the problem "Intensification of Agrarian Production" there is coincidence in most cases in not considering it relevant, as it was

**Table 2**

Most relevant problems based on mention percentage of the respondents' answers according to the analysis level (T: threshold). The various comparisons are considered by verifying the coincidence (C) in relevance between the pairs of cases of each one: ✓+ there is agreement on the relevance; ✓- there is agreement on non-relevance; X there is no coincidence.

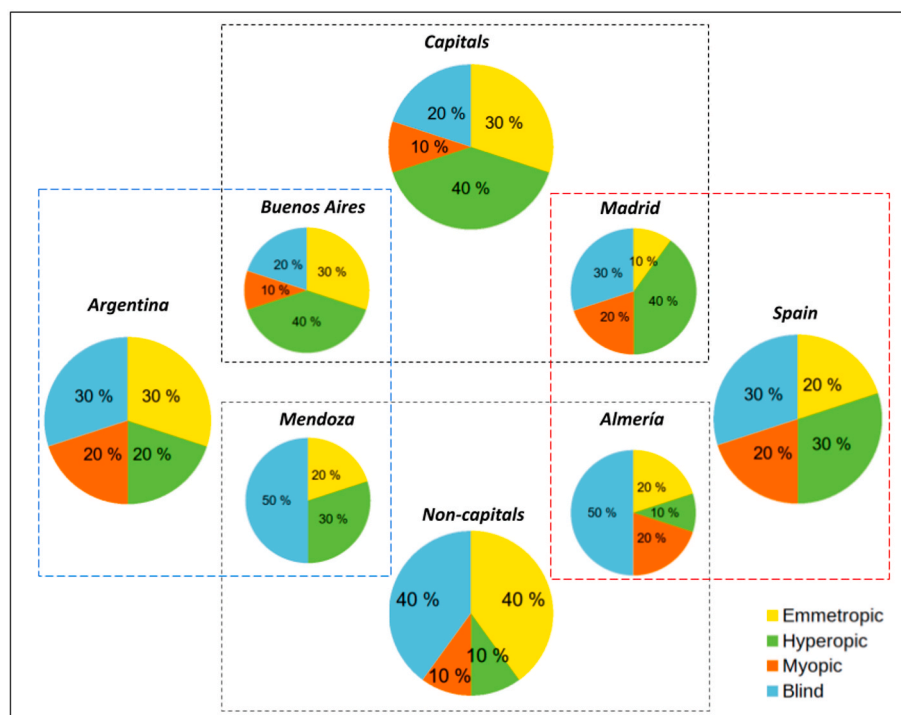
Environmental problem	Analysis levels											
	International			Political-administrative			Dimensional					
	Argentina (T: 27.50)	Spain (T: 31.50)	C	Capital cities (T: 28.50)	Non-capital cities (T: 30.50)	C	Argentina			Spain		
							Buenos Aires (T: 29.50)	Mendoza (T: 30.00)	C	Madrid (T: 31.40)	Almería (T: 31.00)	C
Air pollution	30.00	30.00	X	34.00	26.00	X	38.00	24.00	X	31.00	28.00	✓-
Water pollution	55.00	27.00	X	44.00	36.00	✓+	59.00	53.00	✓+	34.00	17.00	X
Global pollution	24.00	38.00	X	25.00	45.00	X	23.00	34.00	X	25.00	57.00	X
Deforestation	48.00	45.00	✓+	47.00	46.00	✓+	50.00	47.00	✓+	46.00	44.00	✓+
Global change	54.00	63.00	✓+	57.00	61.00	✓+	48.00	60.00	✓+	63.00	62.00	✓+
Plastic waste	8.00	33.00	X	29.00	13.00	X	14.00	4.00	✓-	39.00	23.00	X
Intensification of agrarian production	25.00	9.00	✓-	22.00	10.00	✓-	33.00	17.00	X	14.00	2.00	✓-
Desertification	24.00	22.00	✓-	16.00	31.00	X	12.00	35.00	X	19.00	26.00	✓-
Discharges	38.00	14.00	X	32.00	18.00	X	52.00	25.00	X	18.00	9.00	✓-
Biodiversity loss	26.00	35.00	X	34.00	26.00	X	30.00	22.00	X	38.00	31.00	✓+

only highlighted in one case, Buenos Aires. Another remarkable result is related to the problem “Global Pollution” where the highest disagreement occurs. Something similar occurs with “Plastic Waste”, “Biodiversity Loss”, “Discharges” and “Air Pollution”, given that they do not coincide in their relevance at almost any level, but particularly in Argentina there is coincidence in considering the problem of plastics as not relevant.

On the other hand, it is observed that, within Spain, there is a high degree of agreement as to the relevance or not, given that 70% of the problems are evaluated similarly in their cities (indicated with ✓ in Table 2), while in the rest of the comparisons there is less agreement in the mention of the problems, where this occurs in only 40% of the cases.

**4.2. Different attitudes of respondents regarding the perception of environmental problems**

Dominance of attitudes varies across the different analysis levels (Fig. 4). At international level (Argentina-Spain) emmetropic and hyperopic attitudes predominated with 30%, respectively and blind attitude occupies an equally important place. On the other hand, at the level of capital cities prevailing hyperopic attitude (44%), in contrast to what happens in the non-capitals, where blind attitude occupies an important place (40 or 50%). Into a dimensional scale, in Buenos Aires hyperopic attitude (40%) and environmental emmetropia (30%) prevailing, and in Mendoza there was no myopic attitude, prevailing a blind attitude (50%). In Spain, prevailing a hyperopic attitude in Madrid (40%), in contrast in Almería, the environmental hyperopia is a minority (10%).



**Fig. 4.** Frequencies (%) of respondents' attitude by level of comparison: international (Spain - Argentina); political-administrative (capitals - non-capitals); and dimensional within each country.

Comparing the attitudes of the respondents, in both capitals (Buenos Aires and Madrid) hyperopic attitude prevailed, but in Madrid there were more myopic (20%) and less emmetropic (10%) than in Buenos Aires (10% and 30%, respectively). Finally, while in both Mendoza and Almería there was a considerable proportion of blind attitudes (50%), in the Spanish city 20% of respondents were environmentally myopic, which were absent in Mendoza.

Fig. 5 shows that each problem is perceived differently by the identified attitudes. It was analysed which type of attitude of the respondents perceived the different problems (i.e., “how sees what”). In this respect it should be clarified that the only problem seen by all three attitudes was “Water Pollution” (there was no blind attitude). It should be noted that for problems “Global Pollution” and “Biodiversity Loss” no one type of attitude predominates and for pollution-related problems an emmetropic attitude is always present. At the same time, emmetropic respondents are majority in the perception of “Global Change” (75%), while myopic respondents perceive all types of pollution, especially “Global Pollution” and “Air Pollution” (both, 50%). For the other environmental problems, when perceived as relevant, the attitude is hyperopic (i.e. “Plastic Waste”, “Intensification of Agrarian Production”, “Discharges” and “Biodiversity Loss”). Also, 50% of respondents were blind to “Biodiversity Loss” (especially in non-capitals and Argentina, and around 75% to “Desertification”, “Discharges” and “Plastic Waste” (refer to Fig. 3). However, these last three problems differ in the remaining 25%, highlighting a hyperopic attitude for “Discharges” and “Plastic Waste”, and an emmetropic attitude to “Desertification”. This last problem is an exceptional case, as it is only considered relevant in one location (Mendoza) for emmetropic respondents. Finally, “Deforestation” was identified with a hyperopic attitude by all the respondents.

#### 4.3. Relationship between levels of analysis and attitudes towards environmental problems

After performing the Multiple Correspondence Analysis (MCA), the global attitude for each environmental problem was identified in Table 3.

Respondents' attitudes towards environmental problems were predominantly emmetropic and blind at all levels. Specifically, pollution-related problems showed an emmetropic perception in Argentina and in capital cities (i.e. Buenos Aires and Madrid), and this attitude was maintained when analysing the city of Buenos Aires separately. However, for the same problems, an indifferent perception stood out in Spain, together with myopic and hyperopic perceptions in non-capital cities (i.e. Mendoza and Almería) for “Air and Water Pollution”, as well as for “Global Pollution”, respectively. Likewise, the perception towards the problems of “Deforestation” and “Global change” was hyperopic and emmetropic respectively. For the rest of the environmental problems, there was a blind perception at all levels with some exceptions (e.g. myopic and hyperopic perception in Argentina towards “Desertification” and “Discharges”, or the hyperopic perception in Spain and capital cities towards the loss of biodiversity).

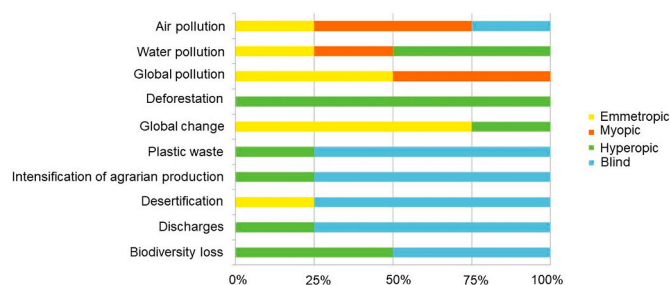


Fig. 5. Distribution of respondents' attitude in terms of the perception of the most relevant environmental problems identified in the cities under study as a whole.

Based on these results, a Hierarchical Classification Algorithm was lead for all environmental problems to group the study areas (i.e., considering the levels of analysis used) according to their general attitude. Graphically, using Ward's distance as a criterion for the generation of hierarchical clusters, spatial dendrogram was obtained (Fig. 6).

Using a maximum Ward's distance of 5.00 as a threshold for the generation of groups taking into account the international, political-administrative and dimensional levels of analysis, it was observed how the study areas were grouped into four clusters according to their similarity in terms of environmental perception: 1) non-capital cities and Mendoza; 2) Spain and Madrid; 3) Almería; and 4) capital cities, Buenos Aires and Argentina.

From a quantitative point of view, the implementation of a mean comparison test made it possible to identify the attitude that defined each cluster generated, and to compare this result with the general environmental perception obtained from all respondents (Table 4).

Overall, problems related to pollution and deforestation were perceived in a hyperopic way, while for the rest of the problems a myopic attitude was observed, except for “Intensification of Agrarian Production”, where there was a tendency towards a blind attitude. More specifically, cluster 1, formed by non-capital cities (i.e., Mendoza and Almería) on a political-administrative scale and Mendoza, showed an emmetropic attitude in aspects related to “Air and Water Pollution”, as well as for “Global Change”. However, in this cluster, a hyperopic perception towards “Deforestation” and “Discharges” was prominent, while a myopic attitude towards the rest of the problems predominated. Cluster 2, formed by Spain and Madrid, was notable for its emmetropic and myopic perceptions towards “Global Change” and “Air Pollution” respectively, with hyperopic perceptions predominating for the rest of the problems, while “Intensification of Agrarian Production”, “Desertification” and “Discharges” were not perceived. Cluster 3 (i.e., Almería) evidenced emmetropic attitude for “Water and Global Pollution”, “Global Change” and “Desertification”, presenting a hyperopic attitude towards “Deforestation” and a blind attitude for the rest of the problems analysed. Finally, cluster 4 (i.e. capital cities: Buenos Aires and Madrid, Buenos Aires and Argentina), although it coincided in its emmetropic and hyperopic attitude towards problems such as “Global Change” or “Deforestation” with the previous clusters, was differentiated by its myopic perception towards “Air and Water Pollution”, and for being the group that perceived the least environmental problems, highlighting a blind attitude towards five problems (i.e. “Plastic Waste” or “Biodiversity Loss”, among others).

## 5. Discussion

### 5.1. Societal attitudes towards environmental problems

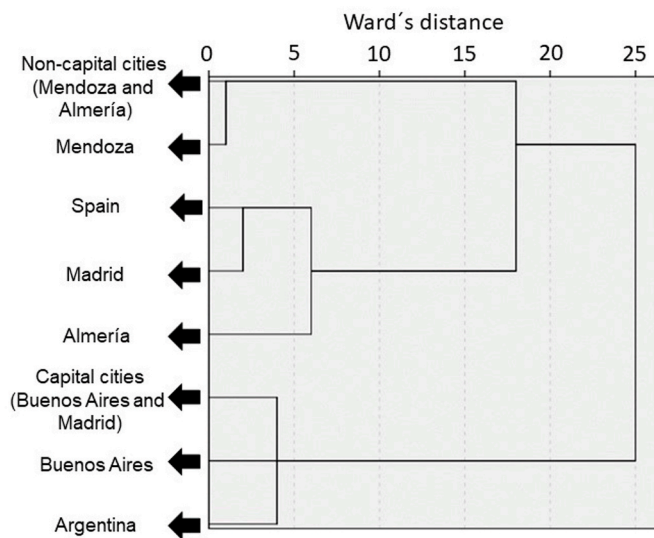
Environmental problems, as an abnormal situation of the ecological values of a locality that affects the population, encompass multiple types of interactions between human activities and nature. In research carried out in different areas (Uzzell, 2000; Sales et al., 2023), some of the environmental problems that also appeared among the most relevant in our study are included, highlighting problems such as climate change (included in this research in global change), water pollution and air pollution. These types of problems, framed in a context of global change, began to be perceived with great concern in recent decades, and their cumulative effects in many cases can lead to critical transitions (i.e. abrupt changes) in many terrestrial and aquatic ecosystems (Zalasiewicz et al., 2017; Scheffer et al., 2001; Rodríguez Sousa et al., 2020).

Our results showed little overlap between countries and cities with different population densities in terms of perceptions of environmental problems. Only high overlap was identified in the perception of their relevance to global change, a multi-causal problem, and deforestation. Deforestation processes, in many cases due to the advance of the agricultural frontier, especially in Argentina, are reaching a spatial dimension of such magnitude that they could be equated with transboundary,

**Table 3**

General attitude observed, from the MCA, for each environmental problem considered at the different levels (where capital cities are Buenos Aires and Madrid; and non-capital cities are Mendoza and Almería).

Environmental problem	International level		Political-administrative level		Dimensional level			
	Argentina	Spain	Capital cities	Non-capital cities	Buenos Aires	Mendoza	Madrid	Almería
Air pollution	Emmetropic	Myopic	Emmetropic	Myopic	Emmetropic	Blind	Myopic	Myopic
Water pollution	Emmetropic	Myopic	Emmetropic	Emmetropic	Emmetropic	Hyperopic	Hyperopic	Myopic
Global pollution	Myopic	Emmetropic	Myopic	Emmetropic	Myopic	Emmetropic	Myopic	Emmetropic
Deforestation	Hyperopic	Hyperopic	Hyperopic	Hyperopic	Hyperopic	Hyperopic	Hyperopic	Hyperopic
Global change	Emmetropic	Emmetropic	Emmetropic	Emmetropic	Emmetropic	Hyperopic	Emmetropic	Emmetropic
Plastic waste	Blind	Hyperopic	Hyperopic	Blind	Blind	Blind	Hyperopic	Blind
Intensification of agrarian production	Blind	Blind	Blind	Blind	Hyperopic	Blind	Blind	Blind
Desertification	Myopic	Blind	Blind	Emmetropic	Blind	Emmetropic	Blind	Blind
Discharges	Hyperopic	Blind	Hyperopic	Blind	Hyperopic	Blind	Blind	Blind
Biodiversity loss	Blind	Hyperopic	Hyperopic	Blind	Hyperopic	Blind	Hyperopic	Blind



**Fig. 6.** Dendrogram, using Ward's criterion, for the grouping of the study areas according to their general attitudes towards the environmental problems analysed.

**Table 4**

Identification of the environmental attitude of each cluster generated together with the overall attitude of all respondents, where 1: Blind; 2: Myopic; 3: Hyperopic; 4: Emmetropic.

Environmental problem	Cluster (spatial scale)				
	1	2	3	4	Global
Air pollution	3.67	2.00	1.50	2.00	2.50
Water pollution	4.00	2.50	3.50	2.00	3.25
Global pollution	2.00	3.00	4.00	4.00	3.00
Deforestation	3.00	3.00	3.00	3.00	3.00
Global change	4.00	4.00	3.50	4.00	3.88
Plastic waste	1.67	3.00	1.00	1.00	1.75
Intensification of agrarian production	1.67	1.00	1.00	1.00	1.25
Desertification	1.33	1.00	4.00	1.00	1.88
Discharges	3.00	1.00	1.00	1.00	1.75
Biodiversity loss	2.33	3.00	1.00	1.00	2.00

regional and even global problems (Magliocca et al., 2022). In the research by García-Mira et al. (2005), environmental problems are grouped according to the level of citizen participation and coincide in being environmental problems that damage the planet. However, there are other problems identified as relevant in our study that can be interpreted from a more specific perspective (i.e. local scale) in terms of their effects on the population and the environment, such as the problems of biodiversity loss and desertification. Biodiversity loss is

perceived as relevant in Spain, but not in Argentina, while the opposite is true for desertification (Otero and Nielsen, 2017; Lorenzo et al., 2018). A mapping of human pressures on biodiversity across the globe showed the complexity of anthropogenic threats that influence the variation of this parameter and found that climate change and other anthropogenic drivers of the effect on biodiversity are unevenly distributed around the world (Bowler et al., 2020; Pereira et al., 2012). Within the cross-country comparison, exposure to different combinations of climatic and non-climatic drivers affecting biodiversity is essentially medium and high in Spain and medium-low in Argentina (Bowler et al., 2020). This likely lower pressure on biodiversity in Argentina could be leading to a lower perception among the respondents.

Desertification and land degradation are growing threats in European Union (EU), yet there is a lack of clear understanding of these challenges and the measures that should be taken to combat them by politicians and policy makers (Sales et al., 2023). However, the awareness of desertification in Mendoza is to be expected, considering that ecosystems of this province are affected by this threat because of sustained human pressure on a highly fragile territory (Abraham and Salomón, 2011). It is striking that in Almería, where there is also a dry climate and the presence of very arid environments, respondents did not consider desertification to be a relevant problem. This is probably due to the notable expansion of plastic and irrigated agriculture, which masks the effects of this problem on the productive sector (Mendoza-Fernández et al., 2021). Intensive agricultural production could be considered a problem of high specificity that is present in the vicinity of two of the locations analyzed (Almería and Buenos Aires) but is perceived as a problem only in Buenos Aires. This may be since the agricultural models in both locations differ in relation to the products obtained and the management modality. Almería's agriculture is based on greenhouse horticultural production, the management of which under plastic is not very visible to the population and, furthermore, there is a high level of agreement among the local population on the economic benefits of this agriculture for the region, downplaying the importance of the environmental effects derived from it (Gil-Salmerón, 2020). On the other hand, agriculture in Buenos Aires is developed on large extensions of land, in most cases being monocultures of soya and maize, which have displaced other activities (de Groot et al., 2021).

Considering socio-economic and geographical conditioning of the respondents in the localities, the results obtained differ from those found by Lee et al. (2015). In such study, geographical proximity is more determinant than GDP and HDI (Human Development Index) levels in the similarity of responses on the degree of perception of climate change. In our case, at the dimensional level within Argentina, there are the same number of coincidences as in the comparison between countries (40%), while within Spain the coincidences in relevance reach a higher value (70%). This indicates that greater geographical proximity does not necessarily lead to similar perceptions. The difference in perceptions between localities within Argentina, equivalent to that found

between countries and greater than within Spain, could be related to Argentina's particular socio-economic structure. Buenos Aires concentrates half of the population and almost 70% of tax revenues, evidencing the marked socio-economic centrality of Argentina and has come to be considered as a Pampean capitalism or Argentine economic exceptionalism (Glaeser et al., 2018).

## 5.2. Socio-spatial context on the perception of environmental problems

In relation to the perception of the effects of environmental problems on the spatial scale (global/local), different attitudes of the population are raised in this study. One of them corresponds to respondents only perceive their immediate environment and direct threats (the individual is affected himself and his local area), being unable to perceive a more abstract conceptual level (Catton and Dunlap, 1978; deHaven-Smith, 1988; Agrawal, 2018). We have termed this type of attitude myopic. This attitude has been identified with this denomination in contrast to the hyperopic attitude detected by Uzzell (2000) in various countries. In such study, he verified that environmental problems at the global level are perceived to be more serious than those at lower spatial levels, finding no cases for the opposite option (no myopic attitude). Other authors such García-Mira et al. (2005) report similar results, while in our study we found both attitudes (myopic and hyperopic) and two other attitudes. One involving near and far vision, which we define as emmetropic and, following the analogy of visual ametropias, a fourth option that we call blind, for those respondents who do not perceive environmental problems. Considering the total set of surveys, hyperopia is more represented than myopia, however, none of the attitudes is associated with a location and/or level of comparison (international, political-administrative function and dimensional). A particular case is the problem of "Water Pollution", which is perceived by the three attitudes that detect problems (i.e. without the blind attitude). In this line, Mateo-Sagasta et al. (2017) detected in a FAO report that water pollution is a growing global concern, while authors such as Reed and Buckmaster (2015) in a United Kingdom (UK) study perceived a greater concern for water pollution in populations closer to water bodies or aquatic environments.

It is possible to affirm that myopic attitude is highly recognised in environmental problems linked to pollution. In contrast to Uzzell (2000), such problems are rarely seen as having an exclusive effect at the global level (hyperopic) but very clearly form part of the holistic view (emmetropic attitude). The results for Mendoza indicate that no myopic attitudes are identified, which could indicate that the inhabitants do not perceive problems to be unique to their locality. Hyperopic perception stands out for the problems of deforestation (100% of respondents), water pollution (50%) and biodiversity loss (50%), which is attributable to their more general and unspecific nature. Other problems perceived with a hyperopic view are highlighted only in some local level with more specificity in their effects on society (especially plastic waste, discharges or intensive agrarian production). These results, referred to "comparable" problems in terms of their effects, seems to indicate that the lower visualisation may not be related to the greater specificity of their consequences but to their greater severity in areas far from the localities of this study. On the other hand, 50% of respondents were blind to biodiversity loss (especially in non-capitals and Argentina) and around 75% to desertification, discharges and plastic waste. In turn, emmetropic respondents are in the majority in their perception of global problems, especially global change (approx. 75%) and global pollution (50%).

When analysing environmental problems from a spatial perspective on whether respondents perceived the effects of environmental problems on a more local or global scale, on an international level of analysis between countries, a different perception was found between Argentina and Spain. The main difference consisted of a perception of the global-scale problems of plastic waste in Spain, due to the environmental awareness of this problem in this country, where plastics pollute aquatic

ecosystems, leading to their eutrophication (Castillo-Díaz et al., 2021; Gibovic and Bikfalvi, 2021). However, in Argentina, fewer environmental problems were perceived, highlighting a blind attitude towards plastics and biodiversity loss, due to the absence of adequate instruments to serve as tools for raising public awareness (Hancke and Suárez, 2014). At the political-administrative level, differences were also observed between capital and non-capital cities. Although capital cities showed similar behaviour to Argentina, non-capital cities were dominated by an emmetropic attitude towards pollution and a myopic perception towards the rest of the problems. This perception of environmental effects at the local scale may be because both Mendoza and Almería are cities more linked to the primary sector, while capital cities are more urban in character, disengaging from the rural environment (Zhou et al., 2020). When analysing the cities independently (i.e. dimensional scale), they all presented different behaviours. While perceptions for Buenos Aires and Madrid were similar to those of Argentina and Spain, Mendoza behaved similarly to the group of non-capital cities, with Almería forming a differentiated group where the emmetropic perception of desertification stood out, due to being a city located in the south of Spain, where there is high water stress and summer drought phenomena, which conditions regional agricultural production (Martín-Rosales et al., 2007; Rodríguez Sousa et al., 2019, 2023).

An important aspect to bear in mind is that the different attitudes of respondents regarding the perception of environmental problems can be influenced by both individual and cultural factors. The way people perceive and understand environmental problems can be influenced by their values, beliefs, previous experiences, and cultural context. These different attitudes may be related to the importance given to environmental problems in a given culture, the valuation of nature, consumption practices, government policies and other socio-economic and political factors. In addition, different policy spaces are likely to reflect and promote different approaches and priorities in relation to environmental issues, which may be influenced by the prevailing perception and culture in those spaces. Political parties and government policies may vary in their commitment to environmental protection and their focus on sustainability, reflecting different perspectives and values present in society.

## 6. Conclusions

Our results showed little overlap between countries and cities of different size, population density and socio-ecological aspects in terms of perceived relevance of environmental problems. More relevant problems were identified in capital cities (Madrid and Buenos Aires), while non-capital cities (Almería and Mendoza) identified fewer relevant problems. Likewise, the results indicate that geographical proximity does not imply similarity in the relevance of the problems or in the attitude with which they are perceived. The results regarding the spatial scale in the perception of environmental problems (local or global effects) corroborated this idea. The differences observed in the hyperopic attitude may probably be related to the dissimilarity in economic income, access to health and the population's link to the environment. It can also be considered in terms of economic dependence on natural resources (as in non-capital cities). These differences can be influential factors in the perception of a problem as an individual (myopic, emmetropic) or external (hyperopic) threat or as a non-threat (blind).

Knowing perceptions is fundamental to generate environmental policies and possible strategies that aim to solve environmental problems more effectively, as they will have the support of the population and will take into account their concern about these problems. Studies such as ours are essential to know the degree of awareness and commitment of the inhabitants, since it is the cities themselves that present the greatest environmental problems and possible solutions to the sustainability challenges (achieving the SDGs targets) of an increasingly urbanised world. Our results show the need to increase environmental awareness campaigns and raise public awareness of the



seriousness of the environmental problems arising from the current environmental crisis, both globally and locally.

### CRedit authorship contribution statement

**Alejandro J. Rescia:** Conceptualization, Validation, Resources, Visualization, Supervision, Project administration, Funding acquisition, Investigation, Writing – original draft, Writing – review & editing. **Daniela Raffin:** Conceptualization, Resources, Visualization, Data curation, Writing – original draft. **Lara Jatar:** Conceptualization, Resources, Visualization, Data curation, Writing – original draft. **Romina Giselle Sales:** Conceptualization, Resources, Investigation, Writing – original draft, Writing – review & editing. **Elisabeth Astrada:** Conceptualization, Data curation, Visualization, Writing – original draft. **Rubén D. Quintana:** Conceptualization, Project administration, Visualization. **Antonio Alberto Rodríguez Sousa:** Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Visualization, Supervision, Writing – original draft, Writing – review & editing.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

All data for the elaboration of the manuscript have been included in the main body of the article.

### Acknowledgements

Thanks to the Complutense University of Madrid (UCM) for their support to carry out this research within the framework of the project entitled “Raising public environmental awareness through scientific and technical training: Connecting wetland conservation with society and the local economy” belonging to the “XV Convocatoria de Ayudas para Proyectos de Cooperación para el Desarrollo Sostenible de la UCM” (XV Call for Grants for Cooperation Projects for Sustainable Development of the UCM) and with the support of the *Instituto Universitario de Desarrollo y Cooperación* (IUDC-UCM). Antonio Alberto Rodríguez Sousa, current Assistant Professor, thanks to the Multiannual call for the requalification of the Spanish University System for 2021–2023 (Margarita Salas Postdoctoral Contract; <https://www.ucm.es/ct31-21>) funded by UCM through the Ministry of Universities, Government of Spain and the European Union – NextGenerationEU, to the project “ASMO - Análisis comparativo de la Sostenibilidad y Multifuncionalidad Olivarera en dos regiones de la Península Ibérica a través de un enfoque de ecología del paisaje: el Alentejo (Portugal) y el Sureste de Madrid (España)”, and to María Aurora Rodríguez Sousa for her support and advice. Finally, we would like to thank Pedro Cuesta, for his advice on the statistical methodology used, and Martina Gómez Trevijano for her invaluable collaboration in the digitalisation of the survey data.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jclepro.2023.138882>.

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