Perception of the value of biodiversity in a peri-urban space

Comparative approach in two case studies in the Metropolitan Area of Lisbon

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Abstract

The expansion of the human action has led to habitat destruction and to the extinction of a large number of species, which has economic, ecological and social implications. The involvement of the citizens in conservation policies in order to stop the loss of biodiversity of the last decades will benefit with the understanding of the knowledge lay people have of the concept of biodiversity, as well as with the understanding of their attitudes towards the environment. This thesis will contribute to the understanding of that knowledge and of the value that the public attaches to biodiversity taking into account the experts' interpretation.

Due to little research that informs about lay people's perceptions, this study focuses on the valuation of the social representations of the concept of biodiversity and the value orientations that the population of two parishes included in a peri-urban area have. It seeks to understand how the public identifies and perceives biodiversity preservation, as well as the influence biodiversity has on aesthetic preferences.

Thus, the methodology used combines attitude's scales, visual methods and open questions on a questionnaire that was applied in two parishes in the Metropolitan Area of Lisbon with different characteristics in terms of biodiversity. The results allowed to achieve the proposed goals and to identify the influence of the parishes' different characteristics in the way the population perceives biodiversity, as well as the limitations of the methods used in this approach.

Key words: biodiversity value, public perception, value orientations, peri-urban

1. Introduction

1.1. Framework and Objectives

Human expansion has been dramatically altering ecosystems, leading to the destruction and fragmentation of habitats and to the extinction of a large number of species. There has been registered a large reduction of biodiversity in Portugal, achieving proportions never achieved before, which leads to ecological, economic and social implications. Since a great part of the global economy and human needs are dependent of the biological resources, it is essential a good biodiversity management and protection. To stop this biodiversity loss and recover habitats and natural systems, the EU has created the strategy "Halting Biodiversity Loss by 2010", which failed due to the lack of public understanding of biodiversity's importance.

Despite the importance of public support in conservation policies, the lack of scientific knowledge has been used to argue against public participation in decision-making and policy development (Fischer & Young, 2007). What is found, however, is that the apparent lack of scientific

knowledge amongst the population, lay people can show a type of knowledge that benefits and complements the knowledge of experts (DeWalt, 1994). Since public support is necessary for biodiversity conservation (Callicott, 2006), the understanding of their perceptions and value orientations is of extreme importance. In order to understand better this perceptions, the measurement of environmental attitudes of lay people is essential, and should be taken into account that these can be influenced by different places and cultures, making the understanding of this differences of utter importance to conservation policies.

There's a lack of studies in Portugal about the value people give to biodiversity and how they define them. Thus, the aim of this study is to comprehend the concept of biodiversity of the inhabitants of two parishes in confrontation with the experts understanding, as well has understand people's value orientations, assess their knowledge of biodiversity, understand the relation between preferences and biodiversity's value and understand their opinions regarding the preservation of biodiversity.

1.2. Methodology

This work was divided in two case studies: in the first case study, a literature review allowed the construction of a scale to assess biodiversity, later included, along with the New Ecological Paradigm scale (NEP), in a questionnaire carried out with the participation of students of different courses of Instituto Superior Técnico, in order to validate the biodiversity scale created, so it could be used on the second case study. The surveys were then analysed using the statistical analysis software SPSS. From the results obtained, changes were made to the biodiversity scale, in order to better reflect the biodiversity value dimensions. The second case study is part of the PERIURBAN report. In the context of PERIURBAN, ecology experts elaborated a reclassification of the COS2007 land use cover according to the potential of the value of biodiversity. Based on that data, maps were created that supported the choice of the second case study. This choice was made considering the highest and lowest values of the weighted average of the biodiversity values of the parishes included in the PERIURBAN project. It was created a questionnaire that allowed revealing the knowledge of the population of the concept of biodiversity and existing biodiversity in the parish of residence, their perceptions of biodiversity preservation and value orientations, and their preferences. Consequently, besides the biodiversity scale created and validated on case study 1 and the NEP scale, the survey included a set of open and closed questions, as well as photos revealing different types of values taken in both parishes (previously validated by the ecology experts). The surveys were made in person to the population of both parishes, followed by an analysis of the results using the statistical analysis software.

2. Public perception of the value of biodiversity

2.1. Concept of biodiversity

The expansion of human activities, like agriculture and urbanization has led and continues to lead to the extinction of a large number of species (Groom, 2006), as verified with the failure of the European strategy "Halting Biodiversity Loss by 2010". The term "biodiversity" was only introduced in 1985, and its definition was only established with the Rio Summit (1992) and with the Convention on

Biological Diversity. The Convention on Biological Diversity (1992) defines biodiversity as "*the variability among living organism from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems"*. The issue of biodiversity reached in the last decades proportions that have never been reached before, which will translate into ecological, economic and social implications, making the survival of the human species dependent on biological diversity (ICN, 2002). Thus, good management and protection of biodiversity is essential.

2.2. Value of biodiversity

Knowing and quantifying the value of biodiversity is essential to its protection and preservation. However, severeal studies point out the difficulties in measuring it, both in environmental economics and ecology conservation (e.g. Soliva & Hunziker, 2009). For environmental philosophers, this value can be divided into two major types: intrinsic value or instrumental value (Callicott, 2006). When an entity is an end in itself and its value is independent of another entity, is has intrinsic value. The instrumental value is a material value, is the value an entity has as a means to other entity's end. McFarlane (2005) refers to the existence of value orientations, linked to these general attitudes towards the environment, which can be classified as being anthropocentric or ecocentric. The anthropocentric value depicts a utilitarian view of nature, where natural resources are used to satisfy human needs and desires. The ecocentric value includes aesthetic, spiritual and passive use values, and reflects a belief where nature, regardless of its use for humans, has value simply by existing. Within the anthropocentrism-ecocentrism continuum, Kellert (1996) identifies nine basic values or orientations that express the interpretation of man regarding biodiversity in nature. These nine values consist of utilitarian, naturalistic, ecologistic-scientific, aesthetic, symbolic, humanistic, moralistic, dominionistic and negativistic orientations, that are defined in Table 1.

Table 1 - Typology of basic values attributed to wildlife and biodiversity

Value	Definition
Utilitarian	Practical and material exploitation of nature
Naturalistic	Direct experience and exploration of nature
Ecologistic-Scientific	Systematic study of structure, function, and relationship in nature
Aesthetic	Physical appeal and beauty of nature
Symbolic	Use of nature for language and thought
Humanistic	Strong emotional attachment and "love" for aspects of nature
Moralistic	Spiritual reverence and ethical concern for nature
Dominionistic	Mastery, physical control, dominance of nature
Negativistic	Fear, aversion, alienation from nature

Source: Kellert 1996, 38

In order to measure these environmental attitudes and orientations, Dunlap et al. (2000) created the New Ecological Paradigm (NEP) scale, composed of 15 items. Despite the fact that this

scale distinguishes between anthropocentric orientations and of intrinsic nature, some authors claim that a high score on this scale indicates an ecocentric orientation (Lockwood, 1999).

2.3. Public perceptions

Challinor (1988) states that the solution to the problem of biodiversity is dependent on the behaviour and perceptions of the population. However, a large part of the population does not know or understand the meaning of the term "biodiversity", nor are able to define it (Brown et al., 2004). The lack of support at a local level regarding the implementation of measures to biodiversity conservation has been related to the apparent lack of knowledge about biodiversity, suggesting that local people cannot enjoy the benefits of biodiversity due to their insufficient knowledge (Hunter & Brehm, 2003). The analysis of public understanding and attitudes will benefit with the discovery of their social representations of the concept of biodiversity (Buijs et al., 2008), since the individual will assign certain characteristics to biodiversity through representations of familiar concepts. Social representations are socially elaborated systems of values, ideas and practices that define a certain object to a social group, being used to describe the meaning given to biodiversity.

The individual's daily practices and experiences, knowledge and emotions are connected to the understanding of the concept of biodiversity (Buijs et al., 2008). This raises the issue of the importance of the characteristics of a space as elements that promote or inhibit the use of the space. Areas with an evident landscape value not only encourage the use of space, but are also an important element in strengthening the local identity of the inhabitants.

3. Case study 1

The main goal of this study was to create an attitudes scale that could be used in a real context. Based on the basic values of nature that characterize individual outlooks toward biodiversity defined by Kellert (1996), four dimensions were identified that supported the construction of an attitudes scale toward biodiversity: (1) aesthetic, with 7 items related to the physical appeal and beauty of nature, (2) naturalistic, with 7 items related to direct experience and exploration of nature, (3) ecologistic-scientific, with 7 items related to the systematic study of structure, function and relationship in nature, and (4) utilitarian, with 7 items related to the practical and material exploitation of nature. The answer to these items was given in a Likert-type scale of 9 points, ranging from 1 (completely disagree) to 9 (completely agree). The questionnaire also included the NEP scale of 15 items, developed by Dunlap et al. (2000). The sample included 291 students of Instituto Superior Técnico from various courses.

3.1. Main results

The PCA analysis (Principal Component Analysis) with varimax rotation allowed us to know the number of factors that could be extracted from the biodiversity scale. In order to obtain satisfactory results, it was necessary to hold 5 factor analysis, obtaining a final of 4 dimensions in a 15-item scale – 5 items on the aesthetic dimension, 5 items on the naturalistic dimension, 3 items on the ecologistic dimension and 3 items on the utilitarian dimension. The biodiversity scale created has a high reliability

given by Cronbach's alpha of 0,862 and the four dimensions showed a good to acceptable internal consistency. However, there was a significant but moderate to week correlation between NEP and the biodiversity scale and its four dimensions, contrary to what was expected. After obtaining this results, 5 items were added to the biodiversity scale, 2 items to the ecologistic dimension and 3 items to the utilitarian dimension, in order to balance the number of items per dimension.

3.2. Discussion of the results

This study was conducted in order to test the biodiversity valuation scale created, in order to use it in a real context. The scale allowed us to identify four dimensions of evaluation and interpretation of biodiversity, which were confirmed by the results obtained: (1) aesthetic, (2) naturalistic, (3) ecologistic-scientific, and (4) utilitarian. Nevertheless, it was observed a week correlation between the biodiversity scale and NEP, perhaps due to a misunderstanding of the items presented in the biodiversity scale, which led to different values acquired in both scales. Thus, one should try to understand how individuals interpret these questions, in order to improve and create a more precise scale.

4. Case study 2

The goals of this second study are: (1) to explore the results of the biodiversity scale for the two parishes; (2) to assess the social representations of the concept of biodiversity of the population, as well as their knowledge regarding the existing biodiversity in the parishes; (3) to compare the biodiversity value assigned by the population through photographs, in relation to the value attributed by the experts; (4) to investigate the relationship between the preferences of the population and the value of biodiversity; and (5) to understand the opinions of the population regarding biodiversity preservation. This case study is part of the PERIURBAN research project, that assess the potential for peri-urban areas in order to meet the future challenged for sustainable development. The parishes assessed in this study are Nossa Senhora da Anunciada, in the municipality of Setúbal, and Vialonga, in the municipality of Vila Franca de Xira. These were chosen based on the biodiversity characteristics of the parishes assessed in PERIURBAN. The questionnaire used in this study was comprised of the 20-item biodiversity scale created in case study 1, with a Likert-type scale of 7 points, and of the NEP scale (Dunlap et al., 2000), in order to evaluate the attitudes of the population towards the environment. New questions were also created in order to allow us to comprehend the participants' understanding of the meaning of biodiversity and of the general concept and to understand the participants' biodiversity perceptions and preferences. The sample included 100 individuals – 50 from Nossa Senhora da Anunciada and 50 from Vialonga.

4.1. Main results

Two items were removed from the biodiversity scale, given the dispersion of results and the comments of the respondents during the questionnaire, which showed a lack of understanding of the population regarding these items. There were significant differences between the parishes relating the aesthetic and naturalistic dimensions. In these two dimensions, Nossa Senhora da Anunciada has a

slightly higher average than Vialonga, indicating that these values are higher in the inhabitants of Nossa Senhora da Anunciada. We can also observe that Vialonga scored higher than Nossa Senhora da Anunciada in the utilitarian dimension. Regarding NEP, we can observe that the differences are also only marginally significant, with Nossa Senhora da Anunciada having a more ecocentric vision than Vialonga. These results are featured in Figure 1.

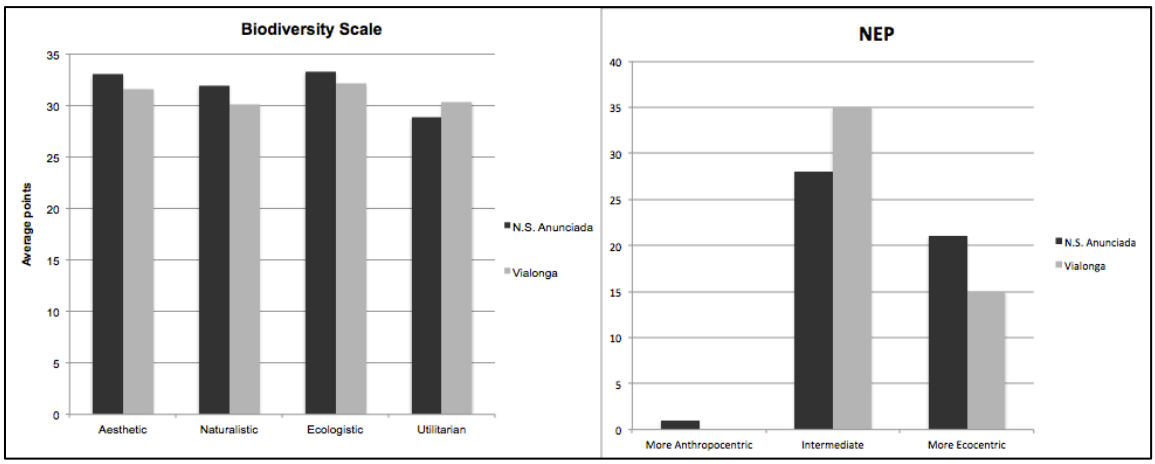

Figure 1 - Values exhibited by the population of the two parishes

The results revealed that in Vialonga there was a greater number of individuals that had never heard of the term “biodiversity” (10 individuals, comparing to 3 individuals in Nossa Senhora da Anunciada) or had heard but didn’t knew its meaning. Despite this, the amount of individuals that could define correctly the term “biodiversity” was similar in both parishes. The inhabitants of Nossa Senhora da Anunciada were able to identify a larger number of places with high biodiversity in their parish, with 86% of the population identifying Serra da Arrábida. In Vialonga, almost 40% wasn’t able to identify a place with high biodiversity. The inhabitants of Nossa Senhora da Anunciada were also able to identify a larger number of characteristic species of the region, with 36% of the inhabitants of Vialonga not being able to identify any species.

When asked to order the photos according to the value of biodiversity, the population of Nossa Senhora da Anunciada was able to order it in a more correct way according to the experts. The population of Vialonga, on the other hand, even though some were able to order it in a correct or almost correct way, there was also a big number of individuals that assigned more value to the photos that represented a lower value. The justifications given for the assignment of a greater and lesser value to the pictures are very similar in both parishes, with the most used for the assignment of a high value being “diversity of vegetation” and “a big amount of vegetation”, and the most used for the assignment of a low value being “urbanization and residential area”.

Regarding the preferences of the population, the inhabitants of Nossa Senhora da Anunciada seemed to prefer the photos that revealed a higher value of biodiversity, while the inhabitants of Vialonga, in general, preferred the ones with a low value. In Nossa Senhora da Anunciada, the reasons most frequently mention to prefer a certain photo were “possibility to enjoy the place” and the ”existence of a great number of plants”, followed by “proximity with nature” and “aesthetics”. In

Vialonga, the most used reasons were “aesthetics” and “little artificiality and human intervention”. The reasons most frequently chosen for the least preferred were “urbanization and residential area” in Nossa Senhora da Anunciada, with Vialonga not having a particular reason that stands. In this parish, the answers are distributed between “artificiality and human intervention”, “urbanization and residential area”, “too much vegetation”, “too little vegetation”, “abandoned space” and “unkept place”.

The results also revealed that all the individuals consider important to preserve places with high biodiversity. From the reasons why we should preserve those places, the most used were “need of oxygen”, “to maintain the human health”, and “the need to exist a balance in nature”. In both parishes, it was also referred frequently the man’s responsibility towards nature. When asked who should have the responsibility to preserve nature, the inhabitants of Nossa Senhora da Anunciada thought, mainly, that is should be the population and the government, while the opinions of the inhabitants of Vialonga, in general, were spread between the population, the parish councils, the city hall, the government and the non-governmental environmental organizations. Regarding what the population thought was a threat to biodiversity, agriculture and cattle breeding were the ones they believed to be the least threatening.

4.2. Discussion of the results

Based on studies where scientific knowledge is used as the only way of measuring the public understanding of biodiversity (Fischer & Young, 2007), it has been suggested that lay people cannot enjoy the benefits of biodiversity due to their insufficient knowledge (Hunter & Brehm, 2003). However, these studies only focus on the adequacy or inadequacy of the knowledge of lay people in comparison to the experts, not taking into account the way the mental constructs of the individual, that are well grounded in complex mental concepts (Fischer & Young, 2007). Therefore, in order to inform the public about the importance of biodiversity, the structure of their knowledge and the way they hold and process environmental information should be taken into account. However, given their complexity, the literature highlights the difficulty of assessing lay people’s value of biodiversity in terms of knowledge, attitudes and emotions, as well as behavioural terms (e.g., Soliva & Hunziker, 2009). To avoid this issue, different methods were used to assess the representations, attitudes and values of the inhabitants of the two parishes. Open questions were used to explore the social representations of the biodiversity concept, an attitudes scale that takes into consideration the 4 dimensions identified in the literature, and visual methods using photographs. This multiplicity of methods allowed us to have a deeper understanding of the lay people’s perception of the value of biodiversity.

The results obtained were above the Eurobarometer (2013) statistic data, that says that 74% of the European population has heard of biodiversity, 44% affirms to know its meaning and 30% doesn't know what it means. Our results show that the 87% of the individuals had heard of the term “biodiversity”, 35% didn't knew the meaning and 22% were able to correctly define biodiversity. Some individuals, however, defined biodiversity as “biological diversity”, making it difficult to assess whether the individual knows, in fact, the meaning of biodiversity, or only resorted to the word formation. Regarding the threats to biodiversity, a lack of knowledge was showed, since agriculture and cattle were not considered, in general, as a threat. These results were seen in both parishes, indicating a

lack of information of the population about the effects of these practices in the destruction of habitats and ecosystems. One possible reason for this result may be the association the lay people make between biodiversity and nature – the concept of nature is associated with what is natural, green, and in that sense, agriculture and livestock appeal to nature. In the absence of concrete knowledge about biodiversity, lay people use concepts close to them linked to biodiversity to define it. This association of biodiversity and nature also appeared when the individuals were justifying their choices about which image they thought had a higher or lower value of biodiversity, since they tend to relate the amount of vegetation with the amount of biodiversity, as well as when people were showing their views on why should places with high biodiversity be preserved. Clearly, lay people tend to associate the concept of biodiversity with the idea of existence of nature or natural elements. Hence, it is important to deliver to lay people the knowledge that nature becomes more valuable when it has diversity.

The biodiversity scale built in the first study evaluates four dimensions identified in literature: aesthetic, naturalistic, ecologistic, and utilitarian. The literature points out that lay people give particular value to the utilitarian criterion (Cottet et al., 2013), making it important to identify what they consider a valuable ecosystem. However, the results obtained in the biodiversity scale show, in both parishes, a lower utilitarian value in relation to the other values. In fact, Kaltenborn and Bjerke (2002) proved that statements expressing the utilitarian value are less accepted than statements that express more ecocentric values. Concerning people's perspectives on why one should preserve biodiversity, a utilitarian view was used as a reason a large amount of times. This goes against the results obtained in the biodiversity scale, which contributes to the idea that some of the individuals didn't answer according to their opinion, but rather what they thought was the general opinion of people. This divergence highlights the importance of using different methods in this type of assessment, since open questions reveal a more honest opinion.

The assessment of the affective relation with nature is important to understand ecological behaviour (Mayer & Frantz, 2004) and can have more impact that information based only on knowledge. Since the emotional processes of an individual are connected to the perception of aesthetic value (Ulrich, 1981), the best way to evaluate the affective relationships is through visual methods, such as the use of photographs. In Nossa Senhora da Anunciada there was a greater preference for images with higher biodiversity value, and the existence of plants and the proximity to nature were the main reason in choosing these photographs. These and the reasons for the lower preferences also show that there is a greater preference for natural landscapes instead of built scenarios (Ulrich, 1983). However, these results were not verified in Vialonga, where there was a greater preference for pictures with lower biodiversity value, but there was a slight preference for landscapes where human intervention is in balance with nature.

The differences observed between the two parishes reflect what was expected: the population of Nossa Senhora da Anunciada is more informed and has a better understanding of biodiversity, reflecting also a greater connection and preference for nature and green spaces. These results are not surprising, due to the recognition Serra da Arrábida has. Being a Natura 2000 classified area and its candidature to UNESCO Heritage of Humanity, there has been and increased propagation of information on its biodiversity, making it a prestigious place for the inhabitants of that regions. Thus,

the existence of areas with high biodiversity, especially protected areas, influences the responses and perceptions of the population, as well as their connectedness to nature. Vialonga contrasts with Nossa Senhora da Anunciada in this aspect. Their inhabitants lack of connection to the place and almost non-existent culture of valuing the hills by their biodiversity characteristics revealed by the PERIURBAN project leads to a higher preference for less natural areas and to a lack of knowledge about the species and most biodiverse places that exist in the parish. However, where the population lives didn't seem to affect the opinion that one should preserve biodiversity, regardless of the reasons.

5. Conclusions

This work intended to give a better comprehension of the understanding lay people have of biodiversity. It explores their value orientations and environmental attitudes, their social representations of the concept and their knowledge regarding the existing biodiversity in the parishes, the value they attach to biodiversity in relation to the value attributed by the experts, the relationship between their preferences and the value of biodiversity, and their perception of biodiversity conservation. In this sense, it was made a research of concepts and methodologies that allowed us to achieve the proposed objectives.

In general, the results allowed us to observe the influence of the population residence in the understanding and awareness of biodiversity: the inhabitants of Nossa Senhora da Anunciada showed a more ecocentric view than the inhabitants of Vialonga, were able to identify more accurately the existing biodiversity in the region and demonstrated a greater connection with nature. These differences were expected, since the parish of Nossa Senhora da Anunciada has a large protected area, Serra da Arrábida, recently mediated by their application to UNESCO patrimony, leading to an increase in the awareness of biodiversity and thus a greater incentive to know more about this area. The inhabitants of Vialonga, on the other hand, show a low identity of place, not valuing the existing places with high biodiversity in the parish for its ecological characteristics.

Although the results obtained in this work contribute to understand lay people’s knowledge and awareness of biodiversity, research on this subject should be continued, since the understanding of biodiversity suggests being strongly influenced by the characteristics of the space. These results shouldn’t be generalized to different spatial contexts, but future studies must take into account that, given its complexity, a combined methodology should be privileged, in light of the fact that it offers different types of knowledge and information about the population studied.

Despite the limitations that the studies here presented might highlight, given the lack of studies in this area, it contributes to gain a greater awareness that the policies designed to preserve biodiversity on a technical-scientific level can bump into a wall of “ignorance” by those who should operate them. Given the scale of the threat of biodiversity loss, it is urgent to rely on the whole society and, therefore, it is also urgent to better understand what each one thinks of it while being able to instigate a real process of communication, where the transmitter and the receiver share a common language, the same concepts, and preferably, the same view of a common future.

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