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# Managing the Conflict of Human–Wildlife Coexistence: A Community-Based Approach

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**Abstract:** One of the most recent and pressing issues for policymakers to address is the presence of wild boars in urban and rural areas. Their aggressive spread and invasion of human-populated areas have created an alarming problem as the coexistence of wild boars and people poses serious threats to human life and property. Human-caused factors, such as residential zone expansion and land use change, have exacerbated this problem. Furthermore, natural factors, such as predator reduction and climate change effects, create favorable conditions for population growth. This study sought to gain insights into citizens' perspectives on a current issue, specifically wild boar colonization and coexistence in urban and rural settings. Between September 2021 and November 2022, a survey was conducted in two communities of northern and central Greece, addressing 800 citizens in total. Obtained through hierarchical log-linear analysis, factor analysis and two-step cluster analysis, the findings indicate that rural citizens appear to be more concerned about agricultural production losses and the high risk of road accidents, while the invasion-level perception was high in both areas. Intensive hunting has gained widespread acceptance as a management tool for wild boar populations in both urban and rural areas, while anthropocentric (EGO) and ecocentric (ECO) social groups have emerged.

**Keywords:** *Sus scrofa*; wildlife; colonization; hybridization; decision making; hunting policy



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## 1. Introduction

Human and wildlife conflicts are common in many countries worldwide as certain pressures deriving from the demand for goods and services have led to the degradation and decline of wildlife habitats [1]. Human population has increased dramatically over the last 50 years, and, as a result, anthropogenic activities such as deforestation and intensive farming have had a negative impact on the extension and balance of wildlife habitats [2]. Large herbivores, such as European ungulates, have fared better in recent decades. The most common ungulates in Europe are wild boar (*Sus scrofa*) and two deer species (roe deer, *Capreolus capreolus*, and red deer, *Cervus elaphus*) [3].

Wild boars range from western Europe and the Mediterranean basin to eastern Russia, Japan and Southeast Asia and have been introduced into the Americas, Africa and Oceania [4]. The habitat in which wild boars are found consists mainly of forest ecosystems, such as oak, chestnut and beech forests, but they also occur in agricultural areas bordering forest areas. Wild boars inhabit all forest vegetation zones if there is dense and leafy cover [5,6]. They now inhabit all continents, except Antarctica [7] and are one of the most widespread mammals in the world. After a sharp population decline before World War II, the species is now the second most abundant ungulate in Europe [8]. The population increase is due to

the reduction in predators [9,10], such as anthropogenic persecution of the wolf *Canis lupus*, land use change and the decline of the human population in rural areas [11,12]. Climate change also favors wild boar populations through milder winters [13,14].

As a species, wild boars are capable of successfully exploiting a wide range of habitats [15], including the transition zone between urban areas, agricultural land and artificial urban green areas [16,17]. In addition, the increasing trend of wild boars is due to their high productivity, great adaptability to a wide range of environmental conditions and mass releases of individuals for hunting purposes [12,18]. Wild boars were historically restricted to natural areas with a low human presence. The simultaneous expansion of the urban environment and increase in wild boar populations favor their invasion of many European cities [19,20] and have resulted in their colonization of several of these cities, including Berlin, Barcelona, Rome and Budapest, over the past several decades [21]. The availability of anthropogenic food resources, including intentional feeding by humans, and water sources in public green spaces is likely to have contributed to the growth of urban wild boar populations [21,22].

Thus, many European cities now have a permanent presence of this species [23–25]. Indeed, since the middle of the 1990s, wild boar populations have been rising in urban and peri-urban regions [26]. The ability of wild boars to adapt swiftly and readily to their habitat can cause numerous problems in agricultural areas and have significant indirect economic effects [4,27]. These impacts correspond mainly to damage and management costs, while agriculture, the environment, government stakeholders and other sectors are the primary recipients of these costs [28]. This phenomenon has inevitably created human–boar conflicts due to the destruction of fruit crops, disturbance or threats to residents, the spread of diseases such as leptospirosis (*Leptospira* spp.) and streptococcus (*Streptococcus* sp.), the degradation of fences in gardens and public parks and the looting of waste bins [18,29,30]. As a consequence of these activities, humanity has begun to view wild boars as dangerous pests rather than as a wildlife species [6]. Wild boars are now regarded as an invasive species and attempts to manage and limit their population by increasing hunting pressure have been ineffectual [12].

The damage caused by wild boar to livestock and crops can result in large financial losses. It has been estimated that, by 2005, the damage caused by wild boars cost the US economy $800 million annually [31]. The destruction of planted pine seedlings by wild boars is the most pervasive and costly type of forest disturbance [32]. Additionally, domestic pig hybridization might have negative financial effects [33]. Road accidents can be a substantial risk posed by wildlife species that live in urban settings [18,34], along with injury risks to humans and pets [26,29,35]. According to Lee [36], 24 people were hurt when 596 wild boars invaded a city center in Korea in 2012. Moreover, bacterial infections (e.g., *Leptospira interrogans* and *Streptococcus* sp.) can spread from wild boars to humans in urban areas, a situation that has occurred in Berlin, Germany [37] and Barcelona, Spain [29]).

Conflicts between wild boars and people have become more frequent as wild boar populations have grown in peri-urban and metropolitan settings neighboring rural ones. Damage by wild boars affects farmed areas, plant variety, vegetation composition and vegetation renewal [38,39]. Additionally, they harm the diversity and quantity of plant and animal species [25,36,37]. Colonization in urban areas and domestication of the species by humans have also increased the damage to urban green areas and the attacks on domestic animals [23]. So far, the policy framework and actions being taken to reduce or avoid the conflict have involved community-based measures, such as encouraging hunters and non-hunters to hunt wild boars even beyond the regular hunting season [40]. Supplemental feeding of wild boar has been a common measure in many parts of Europe to distract animals from crops, but it has been shown to have the opposite effect as crop damage has increased in feeding areas and population growth has been favored as it hastens the onset of wild boar reproduction [41]. Nowadays, in many European countries, such as Greece and Italy, the feeding of wild boars has been banned. The policy framework for controlling wild boar population dynamics and space use appears to be insufficient as the invasion patterns

associated with certain catastrophic effects and threats to human well-being and prosperity tend to be ineffective in reducing wild boars' increasing population and colonization of human-populated areas.

Thus, given the importance of this issue, it is critical to consider citizens' perspectives on the coexistence of wildlife species and humans while developing appropriate policies to address it [42]. New policies are necessary to ensure effective management of the problem of invasive species and provide solutions. These solutions will be accompanied by special measures that will vary depending upon the nation, the locals' attitudes and the various factors that affect each species [43]. Therefore, the public's view of the conflict and the acceptability of the proposed management strategies must be evaluated before implementation.

Community-based research is of the utmost importance in dealing with the conflict of human–wildlife coexistence. Since society bears the brunt of the pressures resulting from the wild boar invasion, which affects people's quality of life, its members should be involved in the decision-making processes to address the issue. As a result, their thoughts on how to solve the problem are valuable and should be considered by policymakers.

Over millennia, Greece has developed an advanced understanding of territories, allowing for a profoundly context-specific and nuanced way for humans to live with nature, settle in landscapes and forge relationships with non-human species. However, despite the nation's long-standing legacy, it has rarely been highlighted in the discourse on biophilia and nature-based solutions. Nature-based solutions rely on the full diversity of forest ecosystems, leaving dead wood in situ, preserving biological refuges and decreasing landscape fragmentation by developing biological corridors to connect the land's habitats. Nature-based solutions are based on a concept developed to incorporate an ecosystem service perspective into spatial planning policies and their implementation, to engage the ecological aspect of conflict solving and to deal with challenging and emerging societal issues in human settings [44]. Meanwhile, there is a clear gap in the documentation, communication, critical evaluation and interpretation of human–wildlife conflict management practices in Greece.

The purpose of this study was to analyze citizens' perspectives on the conflict caused by the presence of wild boars in two different inhabited areas of Greece. It aimed to provide insights into citizens' perspectives on a current issue, specifically wild boar colonization and coexistence in urban and rural settings. It was conducted in an urban area on the outskirts of the metropolitan area of Thessaloniki and in the rural context city of Trikala, which has significant agricultural production activity. An effort was made to understand the variations between citizens' views on how wild boars should be managed in urban and rural areas.

## 2. Material and methods

### *2.1. General*

The following flow chart illustrates the methodology used to evaluate citizens' perspectives on wild boar colonization and coexistence in urban and rural settings (Figure 1). The study began by reviewing all the relevant literature regarding the problem of wild boar expansion and hybridization, the conflict of human–wildlife coexistence and management measures to address the challenge of coexistence. Then, the existing situation in Greece, and more specifically in the areas of interest, was investigated. Subsequently, a questionnaire was created, targeting adult citizens of Pefka (an urban area) and Trikala (a rural area). The questionnaire used in the surveys is provided in Appendix A. The questionnaire's input was structured in accordance with other recent studies that have used questionnaires in interdisciplinary research examining similar issues. To be more precise, the study investigated the citizens' attitudes toward the presence of wild boars; the effects following their hybridization and expansion in the land that the citizens utilize for purposes such as residence and crops; protection measures; and the risks of their coexistence with wild boars, such as car accidents. Some questions asked the citizens to state the extent to which they

agreed or disagreed with the statements while others merely required them to choose the statements with which they agreed. The questionnaires were implemented during personal interviews conducted by trained students, and the interviewed citizens were informed that their responses were anonymous and that they would not be asked to provide any personal data. Finally, for the study to produce specific results and conclusions and to be able to offer effective and concise proposals for future action, descriptive statistics, hierarchical log-linear analysis, reliability analysis, factor analysis and two-step cluster analysis were applied to the collected data.

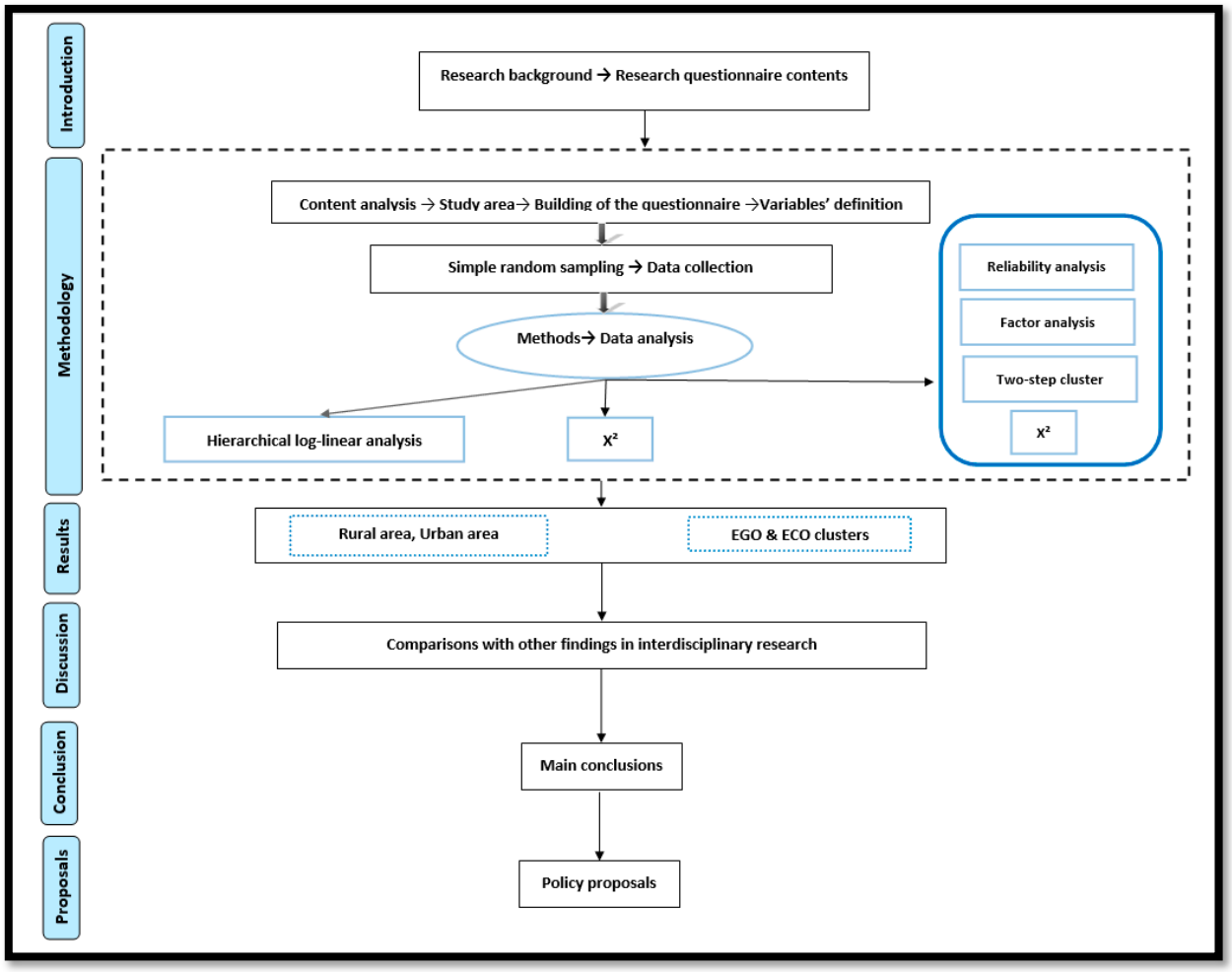


**Figure 1.** Flow chart of the methodology and study structure.

### *2.2. Study Area*

The current study presents two independent investigations using personal interviews and the same questionnaire. The first was conducted in the Municipal Unit of Pefka, with a permanent population of 13,052 people and a total area of 2.57 square kilometers, from September to November 2021. It consists of 51.6% urban land, 17.1% forest and 31.2% scrub and herbaceous vegetation. The Municipal Unit of Pefka borders the peri-urban forest of Thessaloniki (Seich Sou) to the south and a forest area to the north. The Municipal Unit of Pefka administratively belongs to the Municipality of Neapolis–Sykies in Greece.

The second research area is in the Municipality of Trikala, which has a population of 81,355 people and an area of 608.48 square kilometers. The study was conducted from September to November 2022. The current form of the municipality arose from the Kallikratis Project, which expanded the original municipality of Trikala by combining the already existing municipalities of Paleokastro, Estiaiotida, Kallidendros, Megalo Kalibion,

Faloreia, Paralithia and Koziaka. The majority of them are composed of agricultural land (Figure 2). The study areas are 212.69 km apart.

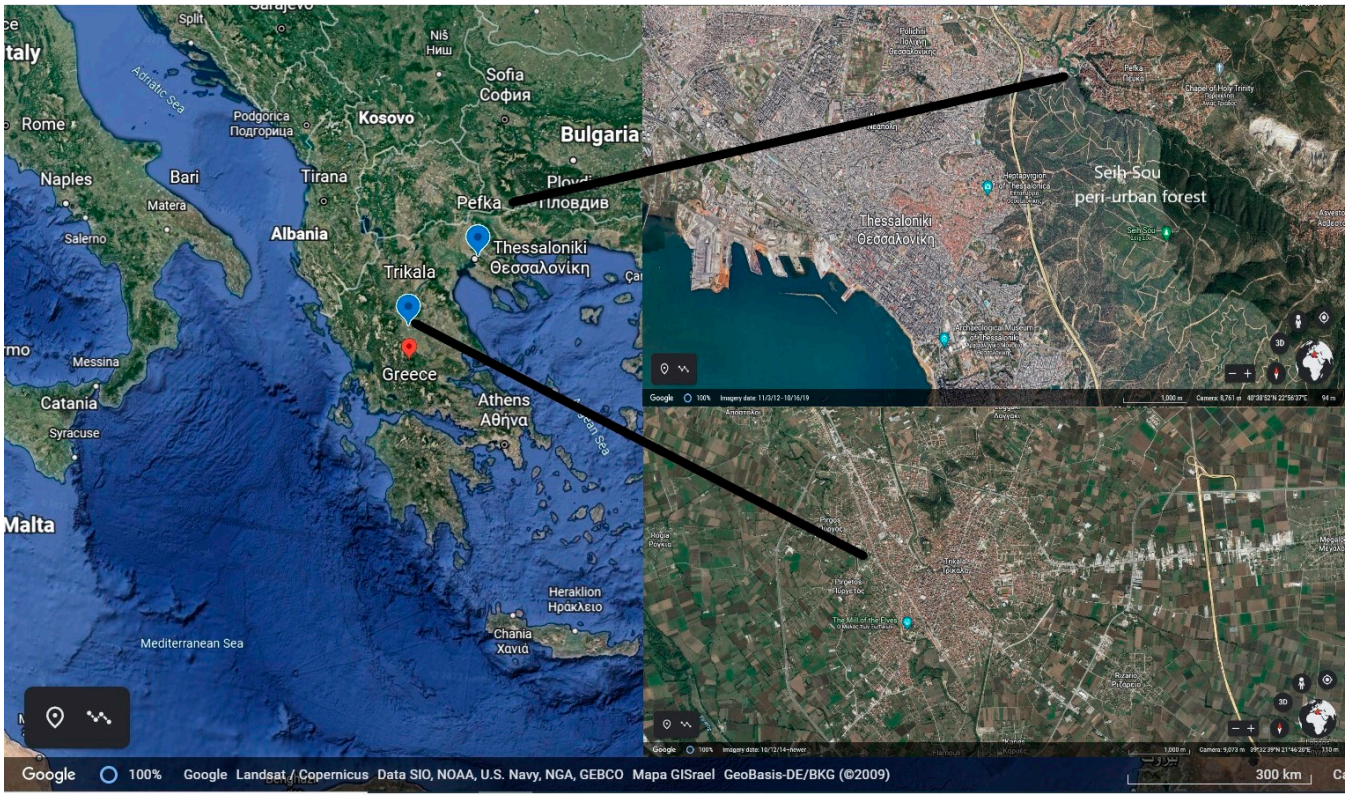


**Figure 2.** The location of the urban and rural study areas in Greece. The top-right map shows the urban area of Pefka and the Seih Sou peri-urban forest of the metropolitan area of Thessaloniki. The bottom-right map shows the map of Trikala in the rural area of Thessaly in central Greece (source: adapted from Google Earth).

In this paper, the first area is referred to as an urban area and the second as a rural area.

### *2.3. The Survey*

In both areas, simple random sampling was applied and accordingly the population proportion (p) and the standard error of the population proportion ($s_p$) were estimated for the qualitative variables [45,46].

To calculate the sample size, we needed to conduct pre-sampling with a sample size of 50 people in both areas. Thus, the proportion was estimated for each quantitative variable. The sample size was calculated using the rules of simple random sampling with replacement [45,47]. Since this sample size n is large relative to the population size N, the finite population correction can be ignored [45,48]. The same questionnaire was used for both groups so that we could process the data together by proceeding to their synthesis and comparing their results. The use of questionnaires is not limited to estimating a single population variable but enables the estimation of multiple variables. Thus, in both areas, the largest sample size was calculated to be 400 citizens (for probability (1-)100 = 95%, e = 0.049, and without finite population correction), meaning a total of 800 citizens. The first survey in the Municipal Unit of Pefka (urban area) was conducted from September to November 2021. The second survey in the Municipality of Trikala (rural area) took place from September to November 2022.

The data were analyzed using the SPSS 28 statistical software package. Data were gathered through face-to-face interviews using a combination of closed-ended and Likert scale questions. The questionnaire covered a wide range of topics to investigate the

magnitude of the wild boar problem, the causes of the wild boar invasion into urban and rural settings, the level of public concern, the level of effective problem management and potential solutions.

### *2.4. Research Method*

#### 2.4.1. Hierarchical Log-Linear Analysis

Hierarchical log-linear analysis was used to examine the three groups of variables. The expected frequencies in the contingency table were considered prior to applying hierarchical log-linear analysis to the assumption of independence [49,50], and the criteria were met by grouping classes together. Hierarchical log-linear analysis was chosen as it is the only analysis that can be used for three or more qualitative variables, and our program itself indicates which pairs of variables are correlated with each other. The five-point Likert scale was used for most of the questionnaire questions. Prior to applying hierarchical log-linear analysis, the expected frequencies in the contingency table were checked to ensure that they are less than 5 but not less than 1 and that they account for no more than 20% of the total frequencies, which can potentially ensure the effectiveness of the applied analysis [51]. Classes were grouped together to satisfy the criteria mentioned by Tabachnick and Fidell [49]. Log-linear analysis represents a particular case of multiple regression analysis, indicating which variables are related to others within a multidimensional contingency table framework [48]. This analysis quantifies the original categorical values as independent variables and is dependent on every window of the intersection table [50,51].

#### 2.4.2. Chi-Square Test of Independence

A second analysis was applied to the data in pairs of variables that were also subjected to the independence test. The assumption of independence denotes the independence of two traits, with $X^2$ serving as the criterion [52,53]. The expected frequencies in the contingency table that are less than 5 but not less than 1 were checked, and these should account for no more than 20% of the total frequencies [51].

#### 2.4.3. Reliability Analysis

The five questions in the questionnaire concerning the solution to the problem of wild boar invasion were defined as a multivariable that was subjected to reliability analysis (the use of fencing and the isolation of wilderness from urban areas; increasing predation where hunting is permitted; the trapping of wild boars in areas where hunting is prohibited and their transportation to protected areas; allowing hunting even in protected areas where hunting is prohibited; the trapping of wild boars in areas where hunting is prohibited and then killing them and disposing of the meat (Question 10, Appendix A)). The degree of variance was defined with regard to the ranking given by the individuals who participated in the research to estimate the reliability of any measurement. We specifically refer to the degree caused by real differences (and standard errors) and the degree caused by measurement inconsistencies [51,54]. The alpha coefficient (or $\alpha$-Cronbach reliability) was used specifically to determine the internal reliability of the questionnaire [55], that is, whether the items tend to measure the same thing [56,57]. An alpha coefficient of 0.70 or greater is considered to be satisfactory [57], a coefficient greater than 0.80 is viewed as very satisfactory and lower reliability coefficients of up to 0.60 are often accepted in practice [50].

#### 2.4.4. Factor Analysis

Factor analysis was performed to describe the relationships between different variables to find possible solutions to the problem of the wild boar invasion. Factor analysis is a statistical method for determining the existence of common factors within a set of variables [51]. In the case study, principal component analysis was chosen. The number of factors was selected in a dynamic process that required repeated evaluation of the model. To that end, the smooth slope criterion was applied to the scree plot [57]. The rotation of

the matrix principal component was applied by employing Kaiser's maximum variance rotation method [58].

#### 2.4.5. Two-Step Cluster Analysis

Two-step cluster analysis was used to group the citizens' perceptions. This method constitutes a research tool that helps to determine clusters with variables of the same characteristics in a large number of data derived from the responses to a questionnaire. The variables were independent of one another; thus, categorical and continuous variables were handled at the same time following the polynomial and the normal distribution, respectively [58–60]. Additionally, the correlation of the other variables (continuous or categorical) in every cluster was separately identified with a check of Pearson's $X^2$. In this way, the identity of every cluster could be determined with greater accuracy. Moreover, with the use of Pearson's chi-squared test, the study evaluated whether there was a relationship between other variables and, in a separate step, whether there were relationships between the clusters. In this way, the identity of each cluster was determined with the highest possible accuracy.

#### 2.4.6. The Classification into Anthropocentric (EGO) and Ecocentric (ECO) Social Groups

Following the regenerative approach as explained by Brown et al. [61], an attempt was made to classify the social groups that emerged. In particular, Figure 3 depicts a segment of human society with an anthropocentric ecosystem (EGO) view of the world, with humans at the top and all other species dominating and serving them. Another part of society shares an ecocentric (ECO) concept and believes that the planet should be protected and managed sustainably and ecologically. These individuals argue that the planet must be saved. Finally, the third group thinks that people understand how to develop a responsible relationship with nature and promote a regenerative vision of world development. This is the social group with the SEVA (service) mindset, which is linked to nature and has emerged as an approach that claims to nourish and care for the Earth. SEVA is claimed to be "a role that can only be performed with a relationship of love and humility to all entities in the environment"; a sustainability SEVA approach is based on reciprocity, in service to others and nature. To that end, we should consider that we have technological and digital solutions, as well as nature-based solutions, and that we now require a new normal, free from the constraints of the old ego–eco norm, to apply and scale up [61].

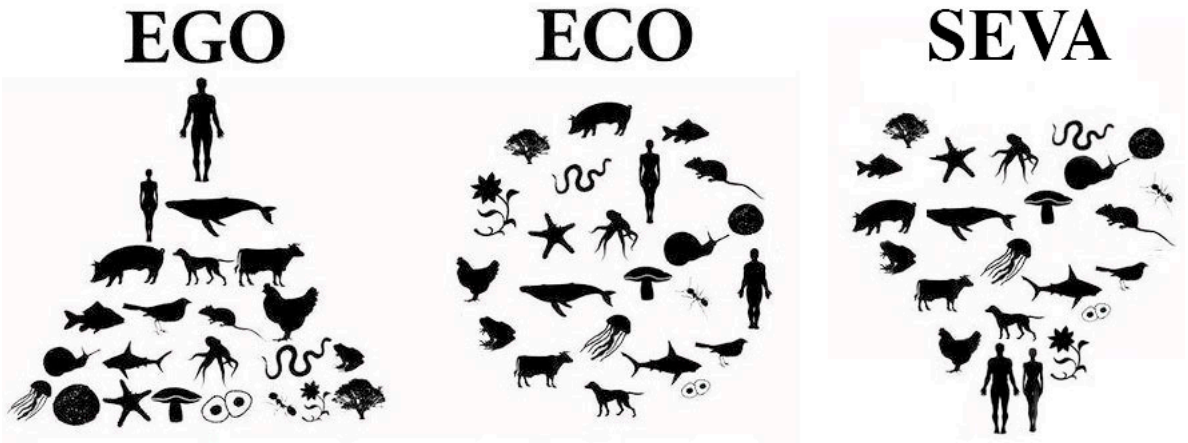


**Figure 3.** The representation of the egocentric, ecocentric and service-minded social groups (Source: adapted from [61] using Freepik).

## 3. Results

### *3.1. Identifying the Problem of Wild Boars*

Most residents in both research areas believe that there is a large invasion of wild boars on the roads (70.3% in the urban area and 73% in the rural area, $s_p = 0.0222$), and fewer people believe that there is a smaller invasion of wild boars in the yards of houses (25.3%, $s_p = 0.0217$ in the urban area and 19.3%, $s_p = 0.0197$ in the rural area). However, there appears to be a concern that wild animals are invading human habitats. The citizens in the two regions perceive an invasion of agricultural crops differently; more specifically, the citizens' percentage in the rural area is 90.5% ($s_p = 0.0147$), while the percentage for citizens living in the urban area is only 23.5% ($s_p = 0.0209$). The rest of the citizens do not perceive an invasion of agricultural crops.

Hierarchical log-linear analysis was implemented for the variables "area", "invasion of wild boars in the yards of houses" and "invasion of wild boars into agricultural crops". There was no interaction between the three criteria because the $X^2$ for Pearson's test is 0.101 with probability (p) = 0.750 and because the $X^2$ likelihood ratio is 0.104 with probability (p) = 0.747. Thus, there is a two-way correlation. The findings are the following:

- The citizens of the urban area state that there is no invasion of wild boars into agricultural crops, while the citizens of the agricultural area believe that there is an invasion of wild boars into agricultural crops;
- The citizens of the urban area state that there is an invasion of wild boars into the yards of houses, while the citizens of the agricultural area state that there is no invasion of wild boars into the yards of houses;
- The citizens who report a wild boar invasion into agricultural crops also report a wild boar invasion into the yards of houses. Meanwhile, citizens who state that there is no invasion of wild boars into agricultural crops also state that there is no invasion of wild boars into the yards of houses.

The rural citizens report a higher wild boar density (population/number) than the urban citizens, a result that can be attributed to the greater mobility of citizens in rural areas, primarily due to their agricultural occupation. The wild boar density appears to be very high for 1% ($s_p = 0.0050$), high for 13% ($s_p = 0.0168$), moderate for 34.3% ($s_p = 0.0237$), low for 29.3% ($s_p = 0.0227$) and very low for 22.5% ($s_p = 0.0209$) of the urban residents; in contrast, it seems to be very high for 19% ($s_p = 0.0196$), high for 48.3% ($s_p = 0.0250$), moderate for 23.8% ($s_p = 0.0213$), low for 6.5% ($s_p = 0.0123$) and very low for 2.5% ($s_p = 0.0078$) of the rural residents.

The wild boar invasion is a topic of discussion very often for 3% ($s_p = 0.0085$), often for 9% ($s_p = 0.0143$), quite often for 30.3% ($s_p = 0.0230$), less often for 38.8% ($s_p = 0.0244$) and not at all often for 19% ($s_p = 0.0196$) of the urban residents. On the contrary, the wild boar invasion is a topic of discussion very often for 18.3% ($s_p = 0.0193$), often for 13.3% ($s_p = 0.0170$), quite often for 29.5% ($s_p = 0.0228$), less often for 28.8% ($s_p = 0.0226$) and not at all often for 10% ($s_p = 0.0150$) of the citizens of the agricultural area. Citizens' social contact is easier in rural areas than in urban areas, and information is transmitted faster.

As a result, the problem of the wild boar invasion is considered to be even worse in rural areas. In particular, for the urban residents, the invasion of wild boars is regarded as an extremely important problem by 5.5% ($s_p = 0.0114$), a very important problem by 10.8% ($s_p = 0.0155$), quite an important problem by 26.8% ($s_p = 0.0221$), a less important problem by 36.8% ($s_p = 0.0241$) and not at all important by 20.3% ($s_p = 0.0201$) of the respondents. Meanwhile, according to the rural residents, the invasion of wild boars is viewed as extremely important for 29.5% ($s_p = 0.0228$), very important for 33.8% ($s_p = 0.0236$), quite important for 22.3% ($s_p = 0.0208$), less important for 12.3% ($s_p = 0.0164$) and not at all important for 2.3% ($s_p = 0.0074$) of the respondents.

Hierarchical log-linear analysis was implemented for the variables "area", "the problem of wild boar invasion" and "wild boar invasion is a topic of discussion". There was no interaction between the three criteria because the $X^2$ for Pearson's test is 2.582 with

probability (p) = 0.275 and the $X^2$ likelihood ratio is 2.567 with probability (p) = 0.277. Thus, there is a two-way correlation. The findings are the following:

- The citizens who state that the wild boar invasion is an extremely to very important problem are from the rural area, while those who state that the wild boar invasion is less of a problem, or no problem, are from the urban area;
- The citizens who state that the wild boar invasion is an extremely to very important problem state that the issue is very often to often a topic of discussion, while the citizens who state that the wild boar invasion is quite important to not at all an important problem state that the issue is quite often or not at all often a topic of discussion.

### *3.2. Causal Factors of Wild Boar Invasion into Urban and Rural Settings*

The evaluation of the reasons behind the problem's magnification according to the citizens of the urban and rural areas is provided in Figure 4a,b. The test of independence was applied after grouping the variables, and the following observations emerged:

- The citizens of the urban area agree (neither agree nor disagree, partially agree and agree) while the citizens of the agricultural area disagree (disagree and partially disagree) on the reason for the escape of wild boars from the breeding farms being either accidental or intentional (the Pearson $X^2$ is 5.816 with 1 degree of freedom while the correlation is statistically significant, $P < 0.016$);
- The citizens of the urban area disagree (disagree and partially disagree, neither agree nor disagree) with the prohibition of hunting in protected areas as a cause of the problem, whereas the citizens of the agricultural area agree (partially agree and agree) ($X^2 = 38.911$, df = 1, $P < 0.001$);
- The citizens of the urban area disagree (disagree and partially disagree, neither agree nor disagree) that the favorable weather conditions helped to increase the wild boar populations, while the citizens of the rural area agree (partially agree and agree) ($X^2 = 78.100$, df = 1, $P < 0.001$);
- The citizens of the urban area agree that feeding wild boars increases their population, whereas the rural citizens disagree (disagree and partially disagree) ($X^2 = 129.293$, df = 1, $P < 0.001$);
- The citizens of the urban area disagree that the low numbers of predators increase the wild boar population, whereas the citizens of the rural area agree (partially agree and agree) ($X^2 = 47.761$, df = 1, $P < 0.001$).

### *3.3. The Level of Public Concern about Safety Issues*

The level of public concern about safety issues related to the wild boar invasion differs in the two areas of interest. The urban citizens feel safer than the rural citizens since almost six in ten (57%) urban citizens claim that they feel quite or very safe, but half (50.2%) of the rural citizens say that they feel less or not at all safe. Therefore, the problem of the invasion of wild boars is regarded as more important in rural areas as the fears of the rural citizens increase due to the frequency of incidents (Figure 5).

The risk of wild boars causing a traffic accident, according to the citizens of the urban area, is extremely significant for 18% ($s_p = 0.0192$), very significant for 24.8% ($s_p = 0.0216$), quite significant for 28.3% ($s_p = 0.0225$), minor for 22.8% ($s_p = 0.0210$) and non-existent for 6.3% ($s_p = 0.0211$). However, for the surveyed citizens of the rural area, it is extremely significant for 51.5% ($s_p = 0.0250$), very significant for 27.8% ($s_p = 0.0224$), quite significant for 14.8% ($s_p = 0.0177$), less significant for 5.5% ($s_p = 0.0114$) and not at all significant for 0.5% ($s_p = 0.0035$). As a result, the risk of a traffic accident is considered to be greater in rural areas than in urban areas.

In both areas, the citizens state that there is insufficient information about the rules that should be followed by citizens regarding wild boars. Specifically, of the citizens in the urban area, 4% ($s_p = 0.0098$) state that they are absolutely informed, 6.3% ($s_p = 0.0121$) that they are very informed, 17.5% ($s_p = 0.0190$) that they are quite informed, 26.3% ($s_p = 0.0220$) that they are less informed and 46% ($s_p = 0.0249$) that they are not at all informed. Meanwhile,

among the citizens of the rural area, 4.3% ($s_p$ = 0.0101) regard themselves as absolutely informed, 6.3% ($s_p$ = 0.0121) as very informed, 12% ($s_p$ = 0.0162) as quite informed, 45.3% ($s_p$ = 0.0249) as less informed and 32.3% ($s_p$ = 0.0234) as not at all informed.

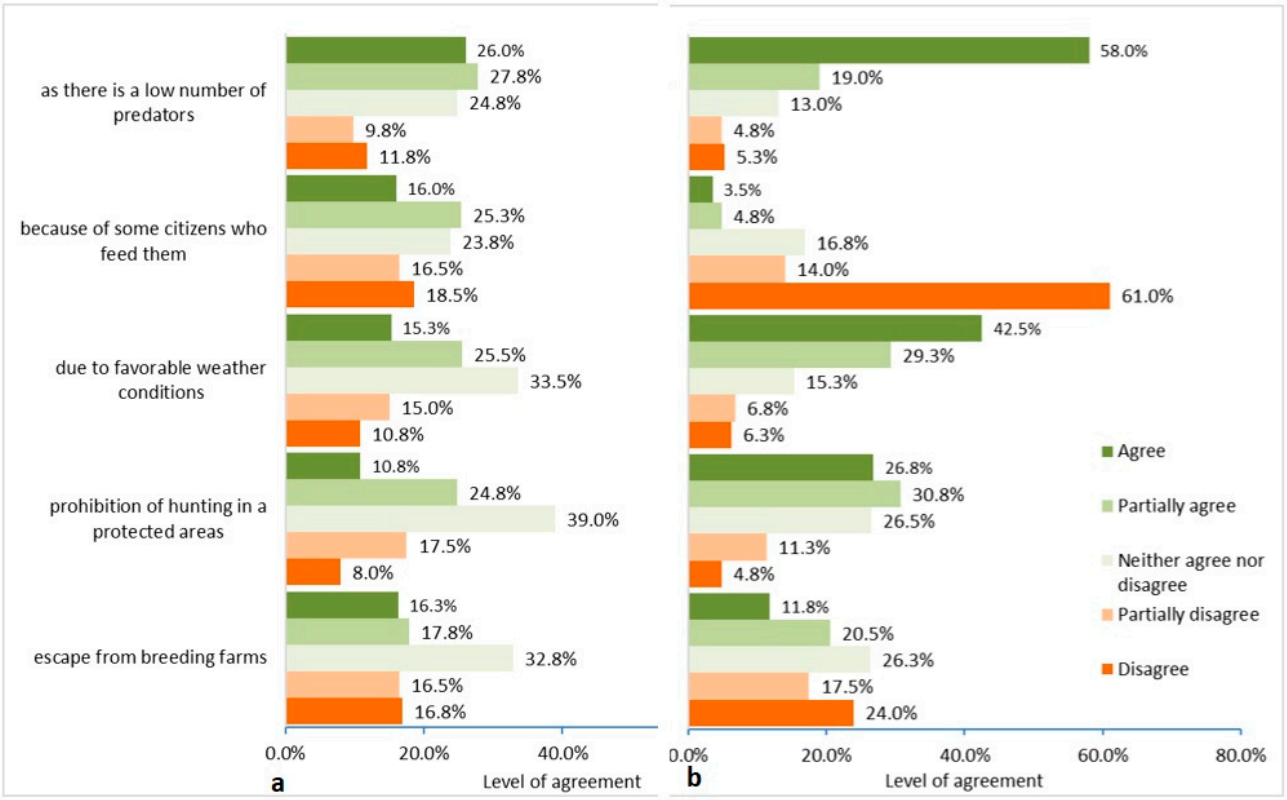


**Figure 4.** (**a**,**b**) The reasons for the magnification of the problem of invasion according to the citizens of the urban area (**a**) and the rural area (**b**).

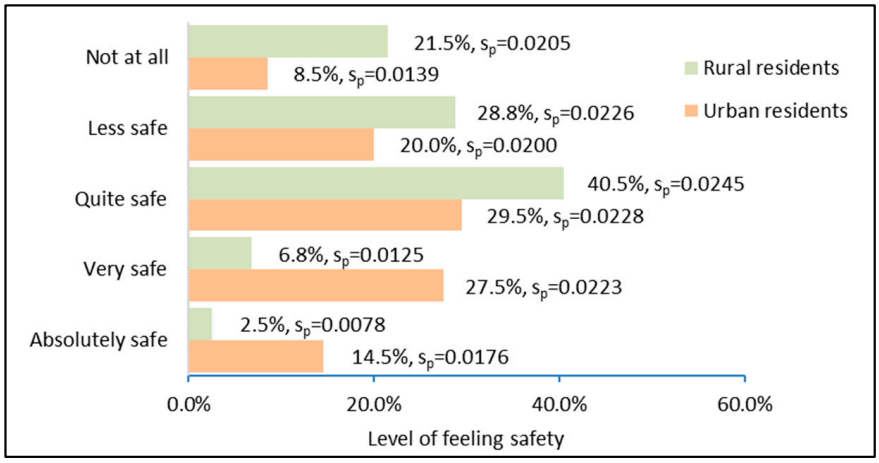


**Figure 5.** Residents' feeling of safety about the wild boar invasion.

### *3.4. The Effectiveness of Conflict Management*

The effectiveness of conflict management was also investigated in the survey. When questioned about how manageable the problem of the wild boar invasion is, 3.5% ($s_p$ = 0.0092) of the urban residents say absolutely, 12% ($s_p$ = 0.0162) very much, 36.8% ($s_p$ = 0.0241) fairly, 32.3% ($s_p$ = 0.0234) a little and 15.3% ($s_p$ = 0.0180) not at all manageable. In the rural area, 3% ($s_p$ = 0.0085) of the citizens declare that it is absolutely, 7.8% ($s_p$ = 0.0134) a lot,

13.5% ($s_p$ = 0.0171) quite a bit, 36.5% ($s_p$ = 0.0241) a little and 39.3% ($s_p$ = 0.0244) not at all manageable.

Hierarchical log-linear analysis was implemented for the variables "area", "risk of traffic accidents" and "manageable problem". There was no interaction between the three criteria because the $X^2$ for Pearson's test is 1.249 with probability (p) = 0.264 and because the $X^2$ likelihood ratio is 1.238 with probability (p) = 0.266. Thus, there is a two-way correlation. The following perceptions were observed:

- The citizens of the urban area believe that the risk of a traffic accident is "minor to non-existent", whereas the citizens of the rural area believe that the risk of a traffic accident is "very to extremely significant";
- The citizens of the urban area think that the wild boar problem is "absolutely to very manageable", whereas the citizens of the rural area think that the wild boar problem is "fairly to not at all manageable";
- The citizens who consider that the wild boar problem is "very much to absolutely" manageable state that there is "quite significant to non-existent risk" of a traffic accident due to wild boars. Meanwhile, citizens who regard the wild boar problem as "a little and not at all manageable" also believe that the risk of wild boars causing a traffic accident is "very to extremely significant".

The respondents were asked to share their thoughts on potential solutions for resolving human–wild boar conflicts. Figure 6a,b display the evaluation of the proposals for resolving the wild boar invasion problem put forward by the citizens of the urban and rural areas. The test of independence was applied after grouping the variables, and the following observations emerged:

- The citizens of the urban area disagree (disagree and partially disagree, neither agree nor disagree) with the use of fencing and the isolation of wilderness from urban areas, whereas the citizens of the rural area agree (partially agree and agree) ($X^2$ = 18.674, df = 1, $P < 0.001$);
- The citizens of the urban area disagree (disagree and partially disagree, neither agree nor disagree) with the solution of increasing predation where hunting is permitted, whereas the citizens of the rural area agree (partially agree and agree) ($X^2$ = 112.500, df = 1, $P < 0.001$);
- The citizens of the urban area disagree (disagree and partially disagree, neither agree nor disagree) with the trapping of wild boars in areas where hunting is prohibited and their transportation to protected areas, whereas the citizens of the rural area agree (partially agree and agree) ($X^2$ = 6.977, df = 1, $P < 0.008$);
- The citizens of the urban area disagree (disagree and partially disagree) with the solution of allowing hunting even in protected areas where hunting is prohibited, whereas the citizens of the rural area agree (neither agree nor disagree, partially agree and agree) ($X^2$ = 87.511, df = 1, $P < 0.001$);
- The citizens of the urban area disagree (disagree and partially disagree) with the trapping of wild boars in areas where hunting is prohibited and then killing them and disposing of the meat, whereas the citizens of the rural area agree (neither agree neither disagree, partially agree and agree) ($X^2$ = 118.499, df = 1, $P < 0.001$).

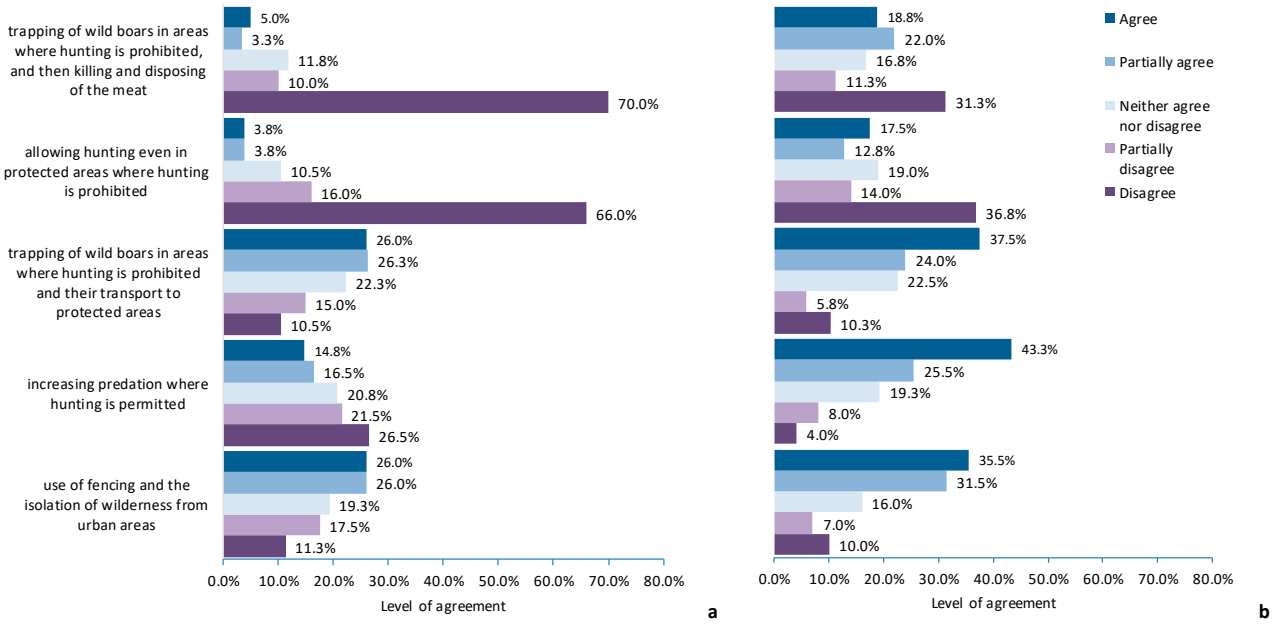


**Figure 6.** (**a**,**b**) The solution to the wild boar invasion according to the citizens of the urban area (**a**) and the rural area (**b**).

### *3.5. Demographic Profile and Social Characteristics of the Population*

The demographic profile and social characteristics of the citizens in both the urban and the rural area are presented in Table 1.

**Table 1.** Demographic characteristics of the citizens in both the urban and the rural area.

| | Urban Area | Rural Area |
|---|---|---|
| **Gender** | | |
| Male | 45.8% ($s_p$ = 0.0249) | 50.0% ($s_p$ = 0.0250) |
| Female | 54.3% ($s_p$ = 0.0249) | 50.0% ($s_p$ = 0.0250) |
| **Age** | | |
| 18–30 | 23.5% ($s_p$ = 0.0212) | 25.3% ($s_p$ = 0.0217) |
| 31–40 | 20.0% ($s_p$ = 0.0200) | 27.5% ($s_p$ = 0.0223) |
| 41–50 | 27.5% ($s_p$ = 0.0223) | 25.0% ($s_p$ = 0.0217) |
| >50 | 29.0% ($s_p$ = 0.0227) | 22.3% ($s_p$ = 0.0179) |
| **Marital status** | | |
| Unmarried | 30.0% ($s_p$ = 0.0229) | 29.5% ($s_p$ = 0.0228) |
| Married | 64.0% ($s_p$ = 0.0240) | 61.8% ($s_p$ = 0.0243) |
| Divorced or widowed | 6.0% ($s_p$ = 0.0119) | 8.8% ($s_p$ = 0.0141) |
| **Number of children** | | |
| No children | 37.0% ($s_p$ = 0.0241) | 36.3% ($s_p$ = 0.0240) |
| One child | 14.0% ($s_p$ = 0.0173) | 13.0% ($s_p$ = 0.0168) |
| Two children | 38.3% ($s_p$ = 0.0243) | 22.5% ($s_p$ = 0.0209) |
| Three children | 9.8% ($s_p$ = 0.0148) | 8.3% ($s_p$ = 0.0138) |
| More than three children | 1.0% ($s_p$ = 0.0050) | 10.0% ($s_p$ = 0.0150) |
| **Educational level** | | |
| Not finished primary school | 2.3% ($s_p$ = 0.0074) | 2.5% ($s_p$ = 0.0078) |
| Primary school | 2.5% ($s_p$ = 0.0078) | 9.5% ($s_p$ = 0.0147) |
| Lower secondary school | 6.0% ($s_p$ = 0.0119) | 12.5% ($s_p$ = 0.0165) |
| Technical school | 6.8% ($s_p$ = 0.0125) | 20.5% ($s_p$ = 0.0202) |
| Upper secondary school | 20.8% ($s_p$ = 0.0206) | 30.8% ($s_p$ = 0.0231) |
| Technological education | 20.8% ($s_p$ = 0.0206) | 10.5% ($s_p$ = 0.0153) |
| University | 41.0% ($s_p$ = 0.0246) | 13.8% ($s_p$ = 0.0172) |

**Table 1.** *Cont.*

| | Urban Area | Rural Area |
|---|---|---|
| **Profession** | | |
| Private employees | 26.0% ($s_p$ = 0.0219) | 13.8% ($s_p$ = 0.0172) |
| Farmers or stock breeders | 2.3% ($s_p$ = 0.0074) | 11.3% ($s_p$ = 0.0158) |
| Students | 11.0% ($s_p$ = 0.0156) | 14.0% ($s_p$ = 0.0173) |
| Public servants | 11.5% ($s_p$ = 0.0158) | 12.3% ($s_p$ = 0.0164) |
| Workers | 1.8% ($s_p$ = 0.0066) | 8.3% ($s_p$ = 0.0138) |
| Housewives | 5.0% ($s_p$ = 0.0109) | 8.5% ($s_p$ = 0.0139) |
| Self-employed | 28.3% ($s_p$ = 0.0225) | 8.3% ($s_p$ = 0.0138) |
| Pensioners | 9.0% ($s_p$ = 0.0145) | 14.3% ($s_p$ = 0.0175) |
| Unemployed | 5.3% ($s_p$ = 0.0112) | 9.5% ($s_p$ = 0.0147) |
| **Satisfaction with their income** | | |
| Absolutely | 4.0% ($s_p$ = 0.0098) | 1.3% ($s_p$ = 0.0056) |
| Very | 6.0% ($s_p$ = 0.0119) | 4.3% ($s_p$ = 0.0101) |
| Mediocre | 34.5% ($s_p$ = 0.0238) | 19.5% ($s_p$ = 0.0202) |
| Little | 31.5% ($s_p$ = 0.0232) | 27.8% ($s_p$ = 0.0224) |
| Not at all | 24.0% ($s_p$ = 0.0214) | 47.3% ($s_p$ = 0.0250) |

### *3.6. The Proposed Solutions According to the Citizens*

Factor analysis and two-step cluster analysis were used to group the respondents' views in the two contexts, namely the urban area that borders the metropolitan area of Thessaloniki and the rural area situated in the agricultural area of Trikala. Reliability analysis was undertaken to assess the consistency of the equivalent questions of the multi-subject variable "Possible solutions to the problem of invasion". The alpha reliability coefficient is high (0.7051). This is a strong indicator that the scale scores are logically consistent, showing that the items tend to measure the same thing. Before performing the factor analysis, we checked the data to ensure that they were acceptable, and we investigated whether all the variables were appropriate to use in the model. The results of the factor analysis are listed in Table 2.

**Table 2.** Factor loadings after rotation (bold numbers show the factor that belongs to each variable).

| Variable | Factor Loadings | |
|---|---|---|
| | 1 | 2 |
| Use of fencing and the isolation of wilderness from urban areas | 0.156 | **0.808** |
| Increasing predation where hunting is permitted | **0.736** | 0.314 |
| Trapping of wild boars in areas where hunting is prohibited and their transportation to protected areas | 0.094 | **0.805** |
| Allowing hunting even in protected areas where hunting is prohibited | **0.865** | −0.036 |
| Trapping of wild boars in areas where hunting is prohibited and then killing them and disposing of the meat | **0.809** | 0.180 |

The first factor includes the variables "increasing predation where hunting is permitted", "allowing hunting even in protected areas where hunting is prohibited" and "trapping of wild boars in areas where hunting is prohibited and then killing them and disposing of the meat" and can be defined as "hunting and killing as a means of conflict solving". The second factor contains the variables "use of fencing and the isolation of wilderness from urban areas" and "trapping of wild boars in areas where hunting is prohibited and their transportation to protected areas", which can be called "isolation, use of fencing and transportation to nature".

Using the two-step cluster analysis program, we obtained a classification of the observations into two clusters, which is an excellent solution. Specifically, 400 citizens (50%) belong to the first cluster, while 400 citizens (50%) belong to the second cluster. As shown

in Figure 6, the model is rated as very satisfactory. It can also be observed that cluster 1 is completely associated with the urban area, whereas cluster 2 is completely associated with the rural area (Figure 7).


**Figure 7.** Diagrammatic results of the two-step cluster analysis's acceptance.

Table 3 lists the characteristics of the clusters. The first cluster, in particular, refers to an urban area where people disapprove of the hunting and killing of animals. In fact, the citizens' isolation from wild boars and their trapping and transportation to nature are viewed as marginally negative, indicating that they are willing to share their space with a wild animal. The second cluster refers to an agricultural area where the hunting and killing of animals are regarded as more positive, while the isolation of the area inhabited by wild boars, their trapping and their transportation to nature are viewed as marginally positive. We could indeed acknowledge that the first group possesses some special characteristics of a social group that insists on nature-based solutions, while the citizens of the second social group appear to have a more anthropocentric view of life.

The findings arising from Pearson's $X^2$ test (for statistical significance $\alpha$ listed), among other characteristics of the questionnaire and the two clusters, are presented at the bottom of Table 3.

ECO cluster: According to Brown et al.'s [61] approach, this cluster shapes the eco-centric social group. The ECO cluster of citizens focuses on a nature-based mindset. The citizens recognize the problem of the wild boar invasion into their backyards rather than into agricultural crops. They consider it to be a minor issue, and they state that the wild boar density ranges from moderate to very low. Furthermore, it appears that the wild boar invasion is not receiving much attention because it is not often a topic of discussion among these citizens.

They assess the problem as having been magnified by the escape of wild boar from breeding units and the practice of citizens feeding them. As a result, they are less likely to accept that the problem has been exacerbated by the prohibition of hunting in protected areas, favorable weather conditions or a lack of predators to balance the population of wild boars. In general, they believe that the problem of wild boar invasion is manageable (fairly to very much). They claim to be absolutely or very safe in the face of the invasion problem and state that they are not at risk of traffic accidents due to wild boars. In terms of demographic and social characteristics, the citizens of the first cluster have a high level of education, have no to two children and are satisfied with their incomes.

**Table 3.** Interpretation of the cluster observations.

| Variables | Cluster 1 | Cluster 2 |
|---|---|---|
| **Area** | Urban area | Rural area |
| **Hunting and killing** | Are considered more negatively | Are considered more positively |
| **Isolation, the use of fencing and transportation to nature** | Are considered marginally more negatively | Are considered marginally more positively |
| **Invasion of wild boars into the yards of houses** ($P = 0.041$) | Yes | No |
| **Invasion of wild boars into agricultural crops** ($P < 0.001$) | No | Yes |
| **Wild boar invasion is a topic of discussion** ($P < 0.001$) | Quite to not at all often | Often to very often |
| **Views about wild boar density (population/number)** ($P < 0.001$) | Moderate to very low | High to very high |
| **Views about the importance of the problem** ($P < 0.001$) | Quite to less important | Very to extremely important |
| **The problem of invasion has been magnified by the escape of wild boars from the breeding farms** ($P = 0.016$) | Neither agree nor to disagree | Partially disagree and disagree |
| **The problem of invasion has been magnified by the prohibition of hunting in protected areas** ($P < 0.001$) | Disagree to neither agree nor disagree | Partially agree and agree |
| **The problem of invasion has been magnified by the favorable weather conditions** ($P < 0.001$) | Disagree to neither agree nor disagree | Partially agree and agree |
| **The problem of invasion has been magnified by citizens who feed wild boars** ($P < 0.001$) | Partially disagree to agree | Disagree |
| **The problem of invasion has been magnified by low numbers of predators** ($P < 0.001$) | Disagree to partially agree | Agree |
| **Feel safe** ($P < 0.001$) | Very to absolutely | Quite to not at all |
| **The risk of wild boars causing a traffic accident** ($P < 0.001$) | Quite significant to not at all | Very to extremely significant |
| **The problem of wild boar invasion is manageable** ($P < 0.001$) | Fairly to very much | A little and not at all |
| **Educational level** ($P < 0.001$) | Higher education (university and technological education) | Lower education |
| **Number of children** ($P < 0.001$) | 0 to 2 children | More than 2 children |
| **Satisfaction with income** ($P < 0.001$) | Absolutely to little | Not at all |

EGO cluster: According to Brown et al.'s [61] approach, this cluster forms the egocentric social group. Citizens of the EGO cluster share an anthropocentric mindset; they identify the conflict as being mainly due to the wild boar invasion into their agricultural crops rather than their backyards. They rank the invasion problem as very to extremely important, and they agree that the wild boar density is high to very high, putting it at the top of the priority list of issues to discuss. They regard the problem as having been magnified by the prohibition of hunting in protected areas, favorable weather conditions and a lack of predators to balance the population of wild boars. Respectively, they are less likely to accept that the problem has been exacerbated by wild boar escapes from breeding units and the practice of citizens feeding them. Overall, they believe that the problem of wild boar invasion is difficult to manage as it is considered to be "a little to not at all manageable". The citizens of this cluster feel unsafe and are concerned about their coexistence with wild boars, which are said to pose a significant risk of causing traffic accidents. With respect to their demographic and social characteristics, the citizens of the second cluster have a lower level of education than the citizens of the first cluster. Furthermore, they have more than three children and are dissatisfied with their incomes.

## 4. Discussion

The invasion of wild boars is closely related to the population expansion of the species, and it is a top-priority challenge that policymakers must address. In the case studies, it became apparent that rural citizens are more concerned about the wild boar invasion than urban dwellers. They first acknowledge the problem as an important challenge as it is related to local economies and crop damage. König et al. [62] presented related findings demonstrating that human–wildlife conflict increases in agricultural areas when crops are colonized by wildlife species as new habitats. Since the early 2000s, efforts to isolate wild animals from agricultural areas have used crop avoidance techniques, such as culling, supplemental feeding and electrical fencing [63], demonstrating that the human–wild boar conflict is more severe in rural areas. The residents of Trikala are very worried about

the problem due to population growth as nearly seven out of ten report that the wild boar density is "high and very high" in this area, and nearly 32% discuss the issue and express their concerns "often and very often". On the contrary, urban residents appear to be less concerned about the wild boar density, with more than half of the respondents admitting that the problem is "less to not at all important", and they notice the invasion problem of wild boars primarily in their yards. Oommen [64], who examined human–wildlife conflicts in India, reached similar conclusions, stating that citizens in rural areas, particularly gateway communities in protected areas, view coexistence as a significant conflict due to loss of human life and crop destruction.

Furthermore, it appears that the residents of the rural area and the residents of the urban area have different perspectives on the causes of the problem. On the one hand, the rural residents reckon that the causal factors for the wild boar invasion are mainly the prohibition of hunting in protected areas, favorable weather conditions which have helped to increase populations and low numbers of predators to reduce the population. On the other hand, the citizens of the urban area believe that the problem stems from certain citizens feeding wild boars and wild boar escapes from breeding farms. A similar survey conducted in mountain towns in Prahova Valley, Romania, by Pătru-Stupariu et al. [65] revealed that different perceptions of the causes of the conflict exist based on the perspectives of local stakeholders. More specifically, the stakeholders indicated deficient forest policies as the root of the problem, such as overexploitation of the species' natural habitat, i.e., the forest, deforestation, construction and infrastructure projects which lead to a lack of food supply for wild boars.

A recent review conducted by Fulgione and Buglione [66] identified, on a global level, five significant factors that have transformed the wild boar and human conflict into an emergency. These are climate change, human-induced habitat modifications, predator regulation of the prey, hybridization with domestic forms and transfaunation. When their findings are compared with those of this study, they show that residents in both areas (Trikala and Pefka) approach the causes in terms of the effects that they personally experience. The latter also explain the different levels of public concern about safety issues, with more than half of the agricultural population declaring that they feel unsafe due to their coexistence with wild boars. It should be noted, however, that both populations express concern about the possibility of a traffic accident involving wild boars. The question is what kind of wildlife collision mitigation measures could be effective. Fedorca et al. [67] emphasized that decision-making in this case is extremely difficult. They also highlighted the importance of effective landscape management using sustainable, local and practical solutions to reduce the high risk to wildlife and human safety. In the same vein, Geeraerts et al. [68] conducted a stakeholder survey addressing farmers, hunters and conservationists in Flanders, Belgium; they concluded that car accidents and crop destruction are major concerns. They also argued that cooperation and synergies among stakeholders and decision-makers are required to address these issues and manage the conflict effectively.

Due to a lack of natural enemies to reduce the population of wild boars, new policies and special measures to manage the conflict are required. The eradication of wild boars is feasible and has been demonstrated in many parts of the world. However, it necessitates time-consuming and costly logistical and financial efforts. In many cases, eradication can only be accomplished by combining two or more techniques [69]. The eradication and management of wild boars constitute a difficult challenge due to the species' biology, reproduction and behavior. Morrison et al. [70] discovered that, after a decline, wild boar populations recover quickly. Furthermore, wild boars that survive the early stages of eradication become more difficult to manage because of the learning process.

The primary method of population management is controlled wild boar hunting. Hunting is also an acceptable solution in both current studies. Regarding urban residents, 40.8% of the Trikala respondents agree or partially agree with the trapping of wild boars in areas where hunting is prohibited and then killing them and disposing of the meat, and 68.5% agree with or partially consent to increase hunting in "hunting permitting areas".

However, hunting has declined in some European countries and is no longer sufficient to slow the rate of population growth [12]. Proposed methods to control wild boar populations include the use of toxic substances, which are not approved in Europe [71], and fertility control [39,72]. The urban dwellers of Pefka are more positive about the integration of nature-based solutions, such as trapping and transferring wild boars to protected areas (52.3% partially agree and agree) and fencing (52% partially agree and agree). Common methods for reducing damage and collisions include the use of repellents, displacement and fencing [38]. However, none of these methods provide a permanent solution for population control because the wild boars' hybridization leads to their high reproductive rate outweighing the potential mitigation provided by these measures [73].

It became evident that the creation of EGO- and ECO-thinking clusters took place in the survey. More specifically, the findings show that urban and rural citizens have different perspectives on dealing with wild boar conflicts and the concept of coexistence in urban and rural settings. The results led to the creation of two clusters in Greek society, namely the ECO and EGO social groups. However, it was not possible to examine and identify the SEVA perspective in the Greek population in the study areas. This was due to the closed questions in the survey questionnaire, which prevented the respondents from participating in a discussion and expanding on SEVA issues.

While it could be argued that supporting the coexistence of humans and wild boars is a daunting task, it is also a fact that government responses should include strategic operational guidance as well as consideration of the benefits derived from the presence of this wild species in both urban and rural settings. Some of the most significant advantages of the presence of wildlife in cities is that it serves as an "ecosystem engineer" for predatory and parasitic species and provides entertainment to humans; it is, therefore, critical to consider the human–wildlife relationship holistically [74]. Along the same line, wildlife's contribution to rural environments, particularly those that are gateways to forest ecosystems, creates a significant advantage because wild boars contribute positively to forest regeneration by digging up the surface soil as they search for food, creating favorable conditions for the growth of new vegetation [6]. The citizens in both regions seem concerned about managing the problem, citing intensified hunting even in protected areas and trapping wild boars, killing them and discarding the meat as more viable solutions for the eradication of the species. Regarding citizens' standpoints on intensifying hunting as a countermeasure for reducing wild boar populations, it is important to stress that the wild boars serve as a substitute for hunting, indicating that hunters prefer to hunt them over other rare species of fauna [75]. Another related study conducted in Poland by Bobek et al. [76] examined one more point, which is the conflict between farmers and hunters, as the latter, through their organized clubs, are not interested in contributing to large recreational game hunting measures to reduce the increasing wild boar population density. Actually, the authors identified similar conflicts to those affecting EGO cluster citizens and proposed a reform of the legislative framework to reduce the population of the species through hunting in a more organized and systematic manner.

On the one hand, the EGO cluster citizens emphasize hunting as a proper conflict resolution strategy, while other studies have proposed nature-based solutions that are more in line with the ECO cluster citizens' beliefs. One such example is the study undertaken by Schley et al. [77] in Luxembourg, in which they proposed replacing crops with ones that are unpalatable to wild boars, particularly in areas that border forests. This proposal stems from an ECO mindset, which stresses the need to understand better the mechanisms that define wild boar damage to enhance agricultural damage prevention strategies.

## 5. Conclusions

The study provides insights into citizens' perspectives on wild boar (*Sus scrofa*) colonization and coexistence in urban and rural environments. The findings might help decision makers to manage the conflict of human–wildlife coexistence. The problem is closely related to residential urban expansion, land use change, natural predator reduction

and climate change effects that create favorable conditions for the increasing wild boar population. The uncontrolled growth of the wild boar population and its presence in urban and rural areas have become a major issue as the invasion poses risks to human property, health and, ultimately, life, since road accidents are on the rise. Endeavors to manage and limit the population through increased anthropogenic persecution have proven ineffective. The current study revealed that, according to the citizens' views, there is a large incursion of wild boars on the roads in both the urban and the rural area. The citizens in the two regions perceive the invasion of agricultural crops differently, with those directly affected—rural residents—expressing strong concern regarding the destruction of their crops. This is obviously related to the fact that rural residents report higher rates of wild boar colonization. The wild boar invasion appears to be a major concern in discussions held by Trikala's rural population, the members of which also see the problem as more serious than the urban dwellers. For the urban citizens, the reasons for its spread appear to be more related to natural causes than anthropogenic effects as they believe that the main reason is the small number of wild boar predators, even though residents may feed wild boars. Meanwhile, the rural residents believe that the ban on hunting in protected areas may be a factor contributing to the spread. The rural residents believe that they are more vulnerable to the wild boar invasion than the urban residents, with the risk of wild boars causing a traffic accident ranking first among the hazards that they face because of the wild boar colonization of their area. It was also evident that responsible bodies, such as the Forest Service and the Civil Protection Service, provide insufficient information to citizens in both areas about the rules that should be followed when dealing with wild boars.

Finally, two groups of citizens emerged as a result of the two-step cluster analysis. The ECO social group was characterized by a higher level of education and income in the urban population, while the EGO social group was represented mostly by the rural population. In rural areas, wild herbivores cause economic damage to agricultural crops, pose a significant problem for them and are difficult to manage. To this end, citizens support the killing of animals and the separation of economically active areas from wild nature using fencing and the isolation of wilderness from human habitats.

## 6. Proposals

Decision makers should focus on coordinated efforts to meet the international commitments to mitigating the effects of global change and combatting wildlife encroachment into human-populated areas. Restoration of degraded forest ecosystems, reforestation and afforestation may be effective strategies for both addressing climatic challenges and restoring wildlife habitats. In fact, this proposal is expected to produce added value on all levels as it is considered a nature-based solution and has a better chance of acceptance by a larger number of people.

The intensification of the recreational hunting of wild boar should be considered by decision-makers and those developing policies to address the expansion of this invasive species as it may provide benefits both for ecosystems and for societies. In addition, it will possibly reduce the pressure on the protected species from poaching. Reinforcing hunting tourism is a measure that will significantly contribute to strengthening policies aimed at mitigating the problem of human–wild boar coexistence.

In addition to hunting, a combination of multiple control techniques is required. This survey was the first attempt to record the views of citizens in relation to the wild boar problem and its management efficiency so far. However, future research should focus on stakeholders such as hunters as well as examining species behavior patterns, creating a database that will allow the problem to be monitored and developing an integrated plan for wildlife managers and policymakers.

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project administration, S.T. and T.P. All authors have read and agreed to the published version of the manuscript.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Data will be available upon request.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A. Human-Wild Boar Coexistence Questionnaire

This questionnaire is anonymous, and confidential, and will be used only for scientific research purposes. The questionnaire has been approved by the Democritus University of Thrace. The aim is to get information about wild boars in the urban and rural contexts. The collected data will help to investigate how humans can coexist with wild boars and how to manage the increasing numbers of wild boars invading the anthropogenic landscapes. Your answers are very important, and we would like to thank you for your willingness to participate.

**(1) In the area you live, there is a large invasion of wild boars . . .**
**on the roads** Yes No
**in the yards of the houses** Yes No
**on agricultural crops** Yes No

**(2) Is the wild boar invasion in your area a topic of discussion for you?**
Very often often quite often less often not at all

**(3) The wild boar density appears to be**
Very high high moderate low very low

**(4) How important of a problem is the wild boar invasion in your area?**
Extremely important very important quite important less important not at all

**(5) Reasons that the problem of invasion has been magnified . . .**

**Due to the escape of wild boars from the breeding farms, either due to accidents or intentionally**
Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree
**Due to the prohibition of hunting in protected areas**
Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree
**Due to favorable weather conditions that helped to increase their populations**
Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree
**Because of some citizens who feed them**
Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree
**Because there are low numbers of predators to reduce their population**
Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree
**Due to other reasons** . . . . . .
Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree

**(6) How safe do you feel from the presence of wild boars in your area?** Absolutely safe very safe quite safe less safe not at all

**(7) How significant do you consider the risk of traffic accidents due to wild boars?**
Extremely significant very significant quite significant a little significant not at all

**(8) How informed are you about the safety rules that you should follow regarding wild boars?**
Absolutely informed very informed quite informed less informed not at all

**(9) How manageable is the problem of wild boar invasion in your area?**
Absolutely very much fairly a little not at all

**(10) The solution to the problem could be**

**the use of fencing and the isolation of wilderness from urban areas**

Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree

**increasing predation where hunting is permitted**

Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree

**the trapping of wild boars in areas where hunting is prohibited and their transport to protected areas**

Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree

**allowing hunting even in protected areas where hunting is prohibited**

Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree

**the trapping of wild boars in areas where hunting is prohibited, and then killing and disposing of the meat**

Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree

**Other** . . . . . .

Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree

**(11)** **Gender:** Male Female

**(12)** **Age:** 18–30 31–40 41–50 >50

**(13)** **Education:** I haven't graduated from primary school

Primary school Secondary school Technical school High school

Higher Technological Institute University

**(14)** **Marital status**

Single Married Divorced

**Number of children:** . . . . . .

**(15)** **Work status:**

Private employee Farmer/Livestock farmer Student

Public servant Worker Housewife

Freelancer Pensioner Unemployed

**(16)** How satisfied are you with your income?

Absolutely satisfied Very satisfied Satisfied Less satisfied not at all satisfied

**Thank you very much for your cooperation!**

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