The Relationships between Public Risk Perceptions of Climate Change, Environmental Sensitivity and Experience of Extreme Weather-Related Disasters: Evidence from Greece

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Abstract: Climate change is one of the most pressing threats facing humanity in our times. Understanding public perceptions of climate change and its risks is the key to any mitigation and adaptation initiatives. Previous works discussed the influence of experiencing climate-related disasters, as well as the role of environmental sensitivity, but also acknowledged important regional variations, gaps and uncertainties. This work focuses on examining the relationship between personal disaster experience, risk perceptions of climate change and ideology with respect to the environment using the New Ecological Paradigm. The study exploits the results of a questionnaire survey in Greece, a characteristic example of the multihazard region of the Eastern Mediterranean. Results show that both direct disaster experience and a person's views on the causes of recent disasters in the country are connected with environmental sensitivity and climate change risk perception in a positive way. Both factors are also correlated with views on the effects of climate change. The findings are in agreement with research outcomes in other areas of the world, showing the importance of disaster experience and the views on extreme events in influencing perceptions of climate change. The work contributes to the growing literature on risk perception of climate change and the role of natural hazards, by adding a new piece in the knowledge puzzle in the climate-sensitive and relatively data-poor region of the Eastern Mediterranean.

Keywords: risk perception; climate change; natural disasters; NEP scale; extreme weather; ecological values; environmental sensitivity

1. Introduction

Climate change can be characterized as one of the most tenacious and pressing threats to humanity today. Its impacts are expected to affect a wide range of sectors and socioeconomic activities to a concerning degree [1]. However, the public cannot fully experience climate change as a direct and present threat [2–4], as in essence, it constitutes a statistical concept of climatological trends [5] that are not always easy to distinguish and identify. On the contrary, people can feel and identify climate change's most extreme expressions (or sometimes perceived expressions) in the form of climate-related disasters and extreme events.

In the last few decades, extreme weather phenomena and hydrometeorological disasters have led the media and members of society to refer frequently to climate change and attribute such events to it [6–9], sometimes even before science determines their causality or links them to it [10]. Nevertheless, understanding people's opinions, views and perceptions of climate change and the environment is crucial in shaping policies and initiatives aiming to reduce risks and enhance adaptation efforts.

Previous works have shown that a variety of factors influence a person's perception of climate change and its risks. Several studies have presented evidence indicating that

previous direct experience with events that are attributed to climate change (e.g., floods) has the potential to affect the perception of an individual on climate change [11–22]. In addition, evidence has been presented showing that experiencing such events is associated with pro-environmental views [23], even though there are contradictory findings [24,25]. Other factors, such as the proximity of an individual to the place where these events take place, have also been found to influence perceptions [12,17]. Apart from perception, there is evidence that attitudes of people who have suffered disasters and ones who have not can be different [18,26], although evidence to the contrary has also been presented [27]. Personal beliefs have also shown an association with risk perceptions of climate change [11,13,14,19,28,29], including political ideology [11,20,28,30–32], as well as current knowledge of climate change [20], personal concern [33] and values and attitudes towards the environment [32–34]. Gender has also been acknowledged by certain authors as a parameter that has been associated with climate change views [20,29,32,33,35,36].

Despite the numerous studies, regionally, there are data-poor areas where our understanding of the role of influencing factors such as the above, as well as laymen's perception of climate change, is limited. For example, in the Eastern Mediterranean region, a critical piece of knowledge related to the role of ecological values and disaster experience on climate change views is largely missing. Climate-related hazards and interaction with public views on climate change remain to a large extent unexplored in the region. Recent review studies in the field in Europe and elsewhere [5,19,20,37,38] show that works in the region are very scarce. In the few studies published, Papagiannaki et al. [39,40] and Diakakis et al. [41] examine natural climate-related hazard perception by the general public but not in relation to climate change, nor in terms of environmental sensitivity. In other published studies, authors deal mostly with knowledge, trust and willingness of citizens to change their attitudes in relation to climate change [42–45] or they target specific professionals [46]. Nevertheless, climate-related disasters are a persistent problem in the Eastern Mediterranean, especially floods and forest fires which cause significant damage and a large number of fatalities [47,48]. In particular, in Greece, recent catastrophes such as the flash flood of Mandra in 2017 (24 fatalities), and the forest fires of Peloponnese and Mati (78 and 102 deaths, respectively) have shown how lethal hydrometeorological hazards can be in the area [49,50].

Understanding the role of people's perception of climate change and their environmental views, particularly in relation to natural disasters occurrence, is critical and necessary knowledge for effective prevention, risk mitigation and climate change adaptation initiatives.

This study aims to contribute to the growing body of literature in the field by providing evidence on the relationships between risk perception of climate change, disaster experience and environmental sensitivity in the data-poor region of the Eastern Mediterranean. The main objective of this paper is to analyze public risk perceptions of climate change and environmental sensitivity and the relationship to the participants' previous experience of a natural disaster and their views on recent climate-related catastrophes, through statistical analyses.

Given that findings from such surveys can vary significantly between different geographical regions due to cultural, environmental or other reasons [38,51–55], the added value of our contribution lies in the fact that it focuses on a largely unexplored region, which is the Eastern Mediterranean and Greece in particular. It is also particularly interesting to examine these relationships in a multihazard environment, in which the population has suffered in recent decades from earthquake disasters (for which perception of risk is very high [56]), but also from important climate-related catastrophes of various types. This regime characterizes the wider Eastern Mediterranean region which is also particularly sensitive to climate change and its impacts [57]. In this way, this work aims to provide a piece of the puzzle of knowledge in the field that is currently missing or is very limited.

The study is organized as follows. First, we present the research framework along with the sample and we define the components analyzed representing the above factors,

followed by a detailed description of our data and methodology used. Then, we discuss the findings and their practical implications.

2. Research Methodology

2.1. Materials and Methods

We conducted the survey among Greek citizens. The study used a questionnaire containing 37 questions classified into four sections as a research instrument to obtain the desired data in a quick and efficient way. More specifically, the first section of the questionnaire was determined to measure respondents' environmental sensitivity. In order to measure environmental sensitivity, the New Ecological Paradigm (NEP) scale was used. The NEP scale was first proposed by Dunlap and Van Liere in 1978 [58]. It was revised almost immediately after its release [59] and then it was revised again in 2000 [60], resulting in its present version. The NEP scale is currently the most widely used method for measuring and studying attitudes and perceptions about the environment [59,61]. At the methodological level, López-Bonilla et al. [62] report that the NEP scale results in two main worldviews: the ecocentric and the anthropocentric. An ecocentric worldview presupposes that individuals understand the value of nature as a common good and the need for protection because of its value. On the contrary, the anthropocentric worldview refers to the idea that humans can manipulate nature and offset the adverse effects that their development has on it.

The second and the third sections of the questionnaire concerned respondents' risk perceptions of climate change and its negative consequences. Last, questions concerning the respondents' demographics were included in the fourth section.

The approach proposed in the present study follows the practice of previous works [63] in order to acquire perception information from different groups of the population in the field of natural hazards and risks.

Preliminary research was carried out during May 2020, while the final questionnaire was distributed during the period between June 2020 and August 2020. Both the preliminary and the final questionnaire were developed using Google Forms and were electronically distributed.

In order to estimate the sample size, we have used the approach of Eng [64]. Thus, the following equation was applied:

$$n = \frac{\left(Z_{1-\frac{a}{2}}\right)^2 \times \overline{p} \times (1 - \overline{p})}{e^2} \tag{1}$$

where:

- n denotes the estimated sample size;
- p denotes the pre-study estimation of the main variable as being representative;
- e denotes the accepted error: in our case 5%, as for our calculations we set a confidence level of 95%;
- $Z_{1-a/2}$ denotes the standard normal deviate, which takes a standard value based on the significance level.

The estimation of the proper sample size from the proportional variables was based on the preliminary research. More specifically, we considered the experience of a natural disaster as the representative variable. Due to the fact that 45.5% of the respondents have experienced a natural disaster in the preliminary research, we calculated that our sample size must be at least equal to 381 responses in order to be representative.

Our final sample consists of 449 valid questionnaires, while the response rate is about 14.3%. It should be noted that 46.3% of the respondents have experienced a natural disaster in the final sample. Therefore, we consider the final sample to be representative, as the percentages of the target variable (e.g., experience of a natural disaster) in both the preliminary and the final sample are almost equal, meaning no difference in the population surveyed. The respondents' demographics are provided in Figure 1.
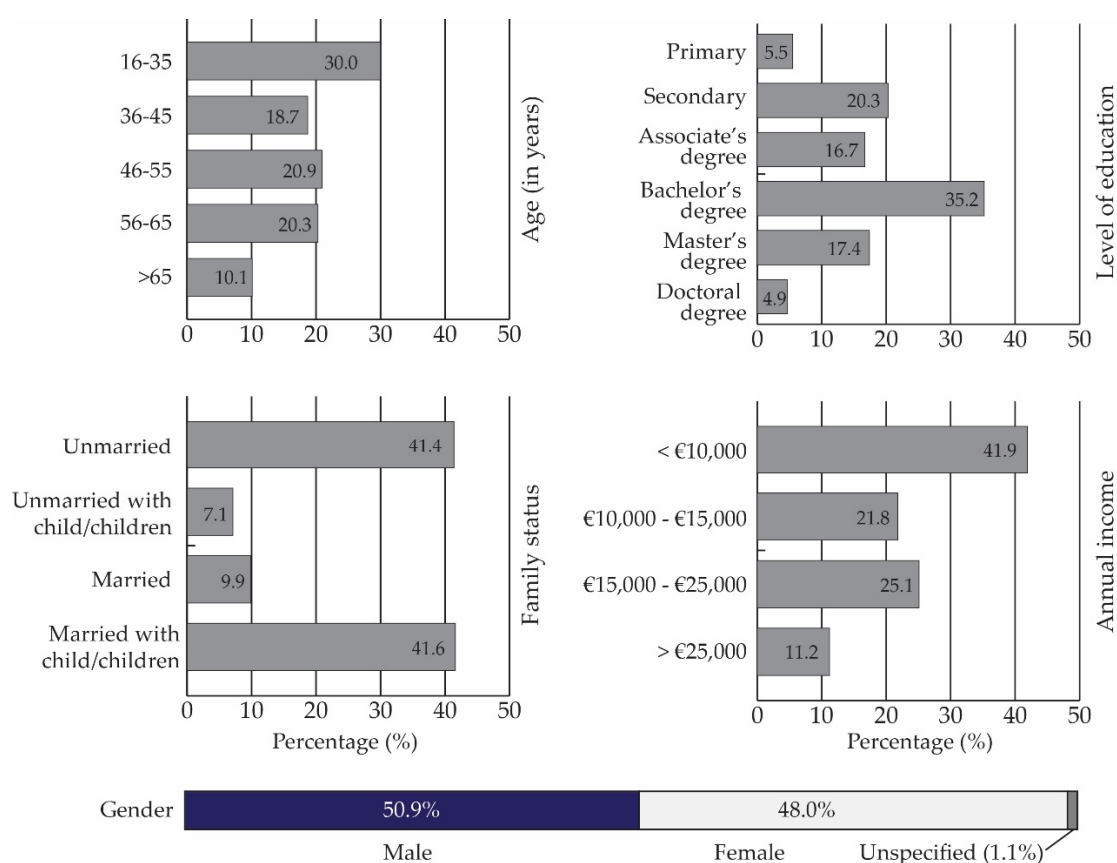
Figure 1. Respondents' demographics.

The collected data were analyzed using SPSS V.26. The primary analysis was based on descriptive statistics, while inductive statistics methods, including principal component analysis, *t*-tests, correlation analysis and regression analysis, were used in order to meet the research objectives.

Initially, the use of descriptive statistics was deemed necessary in order to summarize the obtained data and provide a representation of the sample of a population. Then we used inductive statistics, aiming to draw conclusions for the research population [65]. The inductive statistical tests were selected based on the type of variables that were analyzed in each case. All the tests were carried out at the 0.05 level of significance as followed by most of the researchers in the same scientific field.

More specifically, we initially used a principal components analysis in order to further investigate all the concepts which could not be measured directly by shrinking the large number of their variables into a few interpretable components. The extracted components constituted new variables and were further analyzed. Furthermore, the principal components analysis confirmed that the data fit well into the research concepts [66,67]. *t*-tests were carried out in order to point out if the extracted components concerning the risk perceptions of climate change, the views on the personal effects of climate change and the effects of climate change on the environment differ based on previous experience of a natural disaster. The aim of the correlation analysis was to point out if there is a statistically significant correlation between the above mentioned components. Last, the regression analyses were carried out in order to develop models that explain and predict environmental sensitivity and the component concerning the risk perceptions of climate change. The analytical composition of the research was undertaken in compliance with the steps shown in Figure 2:
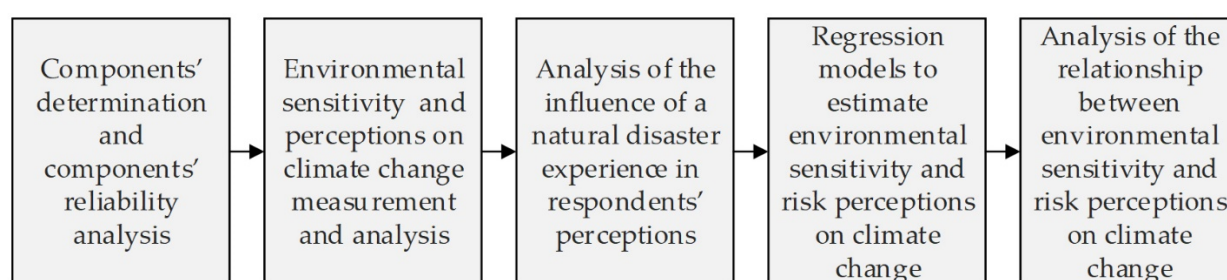
Figure 2. Basic steps of the analysis.

2.2. Components Determination

In this part of the research, the structure of the respondents' environmental sensitivity and views on climate change and natural disasters will be further examined. Following the methods used by other researchers in similar cases [68,69], a principal component analysis (PCA) was initially carried out. Based on the conceptual framework of the PCA method, each one of the components interprets a percent of the variance that has not been interpreted by the other components [70,71]. The PCA was carried out using varimax rotation in order to minimize the number of large weight variables and facilitate their interpretability [70,71].

Concerning the NEP scale, five components were extracted; reality of limits of growth, anti-anthropocentrism, fragility of nature's balance, anti-exceptionalism and possibility of an eco-crisis. These components are the same ones as those identified by Dunlap and Van Liere [58] and Dunlap [59]. The results of Kaizer–Meyer–Olkin's Measure of Sampling Adequacy (KMO = 0.759) and Bartlett's test of sphericity (*p*-value = 0.000) indicated that the data were suitable for PCA. The component matrix is provided in Table A1 of the paper's Appendix A. To measure the NEP scale's components' reliability we have used Cronbach's alpha coefficient. Cronbach's alpha values provided in the following table are greater than the lowest acceptable threshold of the coefficient, which is about 0.7 [72] as shown in the following table (Table 1).

Table 1. NEP scale's components' Cronbach's alpha values.

	Number of Items	Cronbach's Alpha Value
NEP_1: Reality of limits of growth	3	0.846
NEP_2: Anti-anthropocentrism	3	0.761
NEP_3: Fragility of nature's balance	3	0.891
NEP_4: Anti-exceptionalism	3	0.801
NEP_5: Possibility of an eco-crisis	3	0.822

A similar analysis was carried out for the 16 questions concerning the risk perception of climate change and natural disasters. In this case, five components were identified: risk perceptions of climate change, personal effects of climate change, effects of climate change on the natural environment, climate change causality of the recent natural disasters in Greece and human causality of the recent natural disasters in Greece (Table 2). The results of Kaizer–Meyer–Olkin's Measure of Sampling Adequacy (KMO = 0.903) and Bartlett's test of sphericity (*p*-value = 0.000) verified the data suitability for PCA. As in the case of the NEP scale, the component matrix is provided in Table A2 of the paper's Appendix A. Next, the extracted components' reliability is measured. Thus, for the five extracted components which can be considered to be multidisciplinary variables, Cronbach's alpha coefficient is used. In all the cases in the following table, Cronbach's alpha values are greater than the lowest acceptable threshold [72]. Thus, the reliability of all the extracted components is verified (Table 2).

Table 2. Extracted components' Cronbach's alpha values.

	Number of Items	Cronbach's Alpha Value
COMP_1: Risk perceptions of climate change	4	0.780
COMP_2: Personal effects of climate change	3	0.791
COMP_3: Effects of climate change on the natural environment	5	0.861
COMP_4: Climate change causality of the recent natural disasters in Greece	2	0.775
COMP_5: Human causality of the recent natural disasters in Greece	2	0786

3. Results

3.1. Descriptive Analysis

3.1.1. Environmental Sensitivity

The NEP scale's descriptive statistics are provided in Table 3. Due to the fact that the highest percentages of the responses concern a positive attitude towards the environment, the results show that the respondents can be considered to be generally environmentally sensitive (ecocentric worldview) with an overall high score when it comes to ecological values. Taking into account that the NEP scale is measured in a 5-point Likert scale, it is noteworthy that the mean score of answers equals 4.07. Due to the low standard deviations, the views of the respondents tend to be similar to some degree (Table 3).

Table 3. Responses concerning the NEP scale.

NEP Scale's Components	Variable	Cumulative Percent [1]			Mean	Standard Deviation
		Positive	Negative	Neutral		
NEP_1: Reality of limits of growth	1	42.6	21.6	35.9	3.29	1.08
	2	70.3	12.4	17.4	3.83	1.06
	3	62.4	14.8	22.9	3.71	1.08
NEP_2: Anti-anthropocentrism	1	17.2	61.6	21.1	2.29	1.21
	2	73.4	11.9	14.8	3.98	1.11
	3	8.0	79.9	12.1	1.82	1.04
NEP_3: Fragility of nature's balance	1	87.7	2.2	10.1	4.31	0.75
	2	13.0	61.6	25.3	2.33	1.01
	3	75.2	7.5	17.4	3.98	0.96
NEP_4: Anti-exceptionalism	1	36.2	26.2	37.7	3.13	1.0
	2	75.1	7.9	17.0	4.04	1.0
	3	94.1	4.2	1.8	4.5	0.71
NEP_5: Possibility of an eco-crisis	1	31.3	29.3	39.4	2.98	1.08
	2	12.6	73.3	14.1	2.07	1.12
	3	86.6	4.1	9.3	4.30	0.86

[1] "Positive" refers to "agree" and "totally agree" statements, while "Negative" refers to "disagree" and "totally disagree".

3.1.2. Risk Perceptions of Climate Change

Participants were asked about their perception of climate change's importance and the importance of the risks associated with it in a set of questions. Table 4 shows the descriptive statistics of this group of questions. On a 1 to 5 scale, with 1 indicating "totally disagree" and 5 indicating "totally agree", in the first four questions we received high percentages of agreement by the participants (Table 4). Based on the standard deviations it is inferred that all the views of the respondents tend to be similar.

Table 4. Descriptive data on the questions regarding climate change risk perception.

Variable	Cumulative Percent [1]			Mean	Standard Deviation
	Positive	**Negative**	**Neutral**		
Climate change is an issue that is affecting or is going to affect me personally	82.16	3.08	14.76	4.15	0.80
The issue of climate change is an issue of high importance to me personally	81.06	3.30	15.64	4.18	0.82
I am concerned about natural hazards/environmental risks derived from climate change	90.53	1.98	7.49	3.58	0.71
Climate change frightens me	71.37	9.91	18.72	3.93	1.01

[1] "Positive" refers to "agree" and "totally agree" statements, while "Negative" refers to "disagree" and "totally disagree".

3.1.3. Perceptions of Climate Change Effects

As far as the effects of climate change are concerned, we found that a large number of respondents believe that it will have impacts on their personal health, their surrounding environment and their financial situation. Specifically, on a 1 to 5 scale, with 1 indicating "totally disagree" and 5 indicating "totally agree", the majority of questions scored relatively high (Table 5). Higher agreement ratings are found in the case of the impacts on the environment.

Table 5. Descriptive data on the questions regarding the perceptions of climate change effects on person and the environment.

Components	Variable	Cumulative Percent [1]			Mean	Standard Deviation
		Positive	**Negative**	**Neutral**		
Personal effects of climate change (COM_2)	Climate change will have a noticeably negative impact on my health	73.35	7.27	19.38	4.00	0.93
	Climate change will have a noticeably negative impact on my financial situation	59.91	9.69	30.40	3.68	0.96
	Climate change will have a noticeably negative impact on the environment in which my family and I live	78.19	4.85	16.96	4.11	0.85
Effects of climate change on the natural environment (COMP_3)	Climate change may lead to changes in weather patterns and extreme weather events	94.27	1.10	4.63	4.58	0.65
	Climate change may lead to increased flood frequency	94.93	0.88	4.19	4.60	0.61
	Climate change may lead to sea level rise and loss of land	91.63	2.20	6.17	4.54	0.72
	Climate change may lead to global catastrophe	80.40	6.39	13.22	4.18	0.93
	Climate change will affect the occurrence of natural disasters	91.19	0.70	8.15	4.41	0.66

[1] "Positive" refers to "agree" and "totally agree" statements, while "Negative" refers to "disagree" and "totally disagree".

3.2. The Role of Natural Disasters

3.2.1. Direct Disaster Experience

Respondents' previous direct experience of a natural disaster was examined against their risk perceptions of climate change (COMP_1), as well as their views on the personal effects of climate change (COMP_2) and the effects of climate change on the environment (COMP_3). In order to examine the possibility of statistically significant differences in these components against previous experience of a natural disaster, an independent samples *t*-test was carried out (Table 6).

Table 6. Independent samples *t*-test results.

		Levene's Test for Equality of Variances		*t*-Test for Equality of Means	
		F	**Sig. [1]**	**Sig.**	**Mean Difference**
Risk perceptions of climate change	Equal variances assumed	0.164	0.686	0.000	−0.849
	Equal variances not assumed			0.000	−0.849
Personal effects of climate change	Equal variances assumed	0.154	0.695	0.000	−0.789
	Equal variances not assumed			0.000	−0.789
Effects of climate change on the natural environment	Equal variances assumed	58.153	0.000	0.000	−0.527
	Equal variances not assumed			0.000	−0.527

[1] All *p*-values are rounded to the fifth decimal place.

Based on the data provided in the above table, it is evident that there are statistically significant differences between the perceptions of the persons who experienced a natural disaster and the persons who did not experience one, concerning the risk perceptions of climate change (sig. = 0.000), the personal effects of climate change (sig. = 0.000) and the effects of climate change on the natural environment (sig. = 0.000). Based on the values of the variable concerning the personal experience of a natural disaster and the mean differences of the above table, we conclude that when a person has experienced a natural disaster, they tend to have higher perceptions concerning climate change risk as well as its effects.
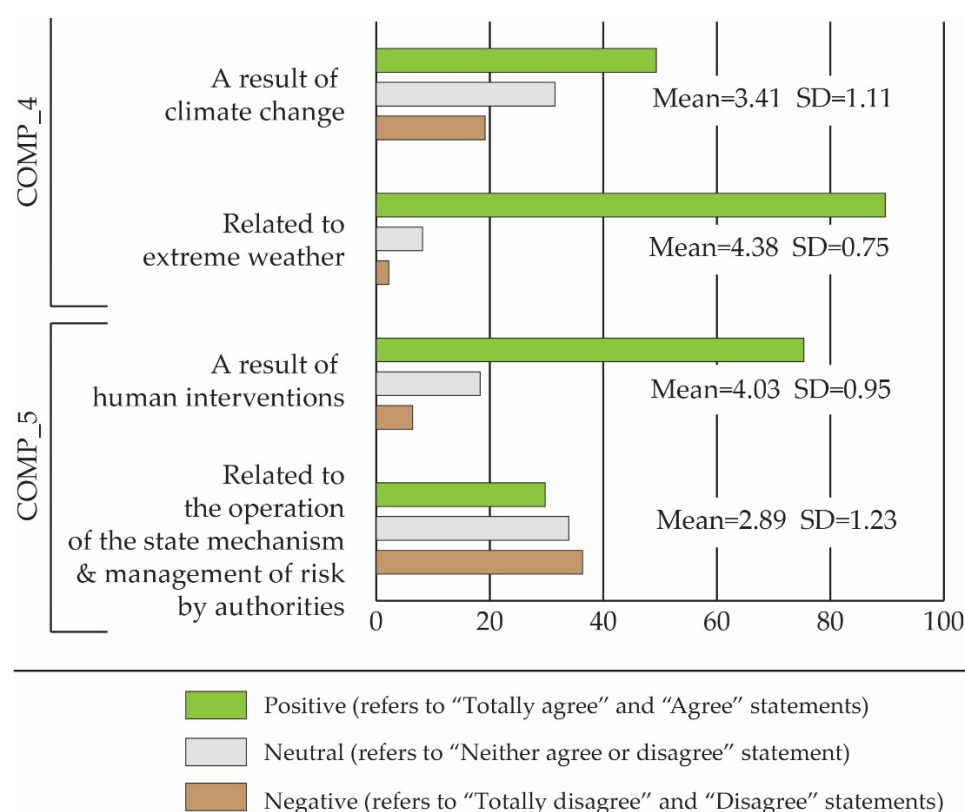
3.2.2. The Role of Recent Natural Disasters

With respect to well-known recent severe natural disasters in Greece (i.e., the flash flood of Mandra in 2017, the wildfire of Mati in 2018 and a tornado in Halkidiki in 2019, all with many fatalities) respondents showed a higher degree of agreement with the attribution of these events primarily to extreme weather or secondly to human intervention with natural processes, rather than to climate change or poor risk management by the authorities (Figure 3).

These views on the causality of recent disasters (COMP_4 and COMP_5) are correlated with the components concerning respondents' perceptions of climate change (COMP_1) and their perceptions of personal effects of climate change (COMP_2) and of the effects of climate change on the natural environment (COMP_3).

Specifically, results showed that there is a statistically significant correlation between the respondents' perceptions and their views on the causes of the recent natural disasters in Greece (Table 7).

Figure 3. Descriptive data on the questions regarding the perceptions of the causes of the recent natural disasters in Greece.

Table 7. Correlation analysis between risk perceptions of climate change, perceptions of personal effects of climate change and perceptions of the effects of climate change and the perceptions of the causes of the recent natural disasters in Greece.

		The Flood in Mandra (2017), the Wildfire in Mati (2018) and the Tornado in Halkidiki (2019), Are:			
		Climate Change Causality of the Recent Natural Disasters in Greece (COMP_4)		Human Causality of the Recent Natural Disasters in Greece (COMP_5)	
		A Result of Climate Change	A Result of Extreme Weather	A Result of Human Intervention	Related to the Operation of the State Mechanism and Management of Risk by Authorities
Risk perceptions of climate change	Spearman's rho Sig. [1]	0.300 0.000	0.239 0.000	0.256 0.000	0.207 0.000
Personal effects of climate change	Spearman's rho Sig.	0.225 0.000	0.284 0.000	0.303 0.000	0.138 0.003
Effects of climate change on the natural environment	Spearman's rho Sig.	0.318 0.000	0.261 0.000	0.148 0.002	0.183 0.000

[1] All *p*-values are rounded to the fifth decimal place.

3.3. Environmental Sensitivity Analysis

In order to examine respondents' environmental sensitivity influencing factors, we have developed a multiple linear regression model. Based on the relevant literature, the NEP scale score was determined as the dependent variable. On the other hand, the experience of a natural disaster, personal effects of climate change (COMP_2), effects of climate change on the environment (COMP_3), climate change causality of the recent natural disasters (COM_4) and human causality of the recent natural disasters (COMP_5) were considered to be the independent ones. The multiple linear regression analysis was

carried out using the stepwise method. Three models are examined, while the third model, which is the best fitting one, is presented in the following table (Table 8).

Table 8. Multiple linear regression model for environmental sensitivity analysis, coefficients and diagnostic tests.

	Unstandardized Coefficients (B)	Pearson's Correlation Coefficient Values	Sig. [1]	VIF
Constant	3.291		0.000	
Experience of a natural disaster	0.318	0.264	0.008	1.023
Human causality of the recent natural disasters	0.286	0.154	0.008	1.029
Climate change causality of the recent natural disasters	0.146	0.122	0.001	1.052
	Diagnostic tests	Tests values	Sig.	
	Adjusted R-squared	0.365		
	Durbin–Watson	1.861		
	ANOVA		0.000	

[1] All *p*-values are rounded to the fifth decimal place.

The findings show that the independent variables concerning the experience of a natural disaster, human causality of the recent natural disasters (COMP_5) and climate change causality of the recent natural disasters (COMP_4) positively affect NEP scale's mean score. The experience of a natural disaster affects the NEP scale's mean score the most (B = 0.318), while climate change as a cause of the recent natural disasters (B = 0.146) affects it the least. These predictors explain the 36.5% of the NEP scale's mean score variance based on the adjusted R squared value. The aforementioned results show the existence of a positive relationship between the experience of a natural disaster and a person's environmental sensitivity as measured by the NEP scale, indicating that people who have directly experienced a natural disaster tend to be more environmentally sensitive.

3.4. Risk Perceptions of Climate Change

A second multiple linear regression model is developed in order to examine influences on respondents' risk perceptions of climate change. In this case, respondents' risk perceptions of climate change (COMP_1) are regarded as the dependent variable, while the experience of a natural disaster, personal effects of climate change (COMP_2), effects of climate change on the environment (COMP_3), climate change causality of the recent natural disasters (COMP_5) and human causality of the recent natural disasters (COMP_5) are regarded as the independent ones. The multiple linear regression model was carried out using the stepwise method. As in the case of environmental sensitivity, the stepwise method examined three different models. The third model, which fits better, is presented in the following table (Table 9).

The data of the above table show that the independent variables concerning the experience of a natural disaster, the personal effects of climate change (COMP_2) and the effects of climate change on the environment (COMP_3) positively affect the risk perceptions of climate change (COMP_1). The experience of a natural disaster affects risk perceptions of climate change the most (B = 0.649), while the effects of climate change on the environment (B = 0.105) affect it the least. The above mentioned predictors explain 69.7% of the variance of the dependent variables based on the adjusted R squared value. The aforementioned results show the existence of a positive relationship between the experience of a natural disaster and a person's risk perceptions of climate change. In essence, this result means that when a person has a direct experience of a natural disaster, they tend to be more sensitive concerning climate change and its effects.

Table 9. Multiple linear regression model for the risk perceptions of climate change analysis, coefficients and diagnostic tests.

	Unstandardized Coefficients (B)	Pearson's Correlation Coefficient Values	Sig. [1]	VIF
Constant	2.075		0.000	1.306
Experience of a natural disaster	0.649	0.282	0.000	1.093
Personal effects of climate change (COMP_2)	0.184	0.122	0.000	1.047
Effects of climate change on the environment (COMP_3)	0.105	0.133	0.000	1.306
	Diagnostic tests	Tests values	Sig.	
	Adjusted R-squared	0.697		
	Durbin–Watson	1.861		
	ANOVA		0.000	

[1] All *p*-values are rounded to the fifth decimal place.

3.5. The Relationship between Environmental Sensitivity and Risk Perceptions of Climate Change

The existence of a correlation between respondents' environmental sensitivity measured by the NEP scale and their risk perceptions of climate change (COMP_1) was examined. The result of Pearson's correlation coefficient (Sig. = 0.000, R = 0.321) reveals a statistically significant and positive correlation between the examined variables.

4. Discussion

This work uses a questionnaire to examine the interplay of relationships between public climate change perceptions and views, environmental sensitivity (expressed through NEP scale), views on the causes of recent catastrophes in Greece and the role of direct climate-related disaster experience.

The results reveal a number of associations between the variables studied as shown in Figure 4.

More specifically, based on Figure 4 we see that environmental sensitivity was found to be influenced by both direct disaster experience and views on the causes of recent notable disasters in the country. Similarly, participants' views on climate change (including risk perception and views on its effects) were found to be connected with direct disaster experience as well as views on the causes of recent notable disasters. Overall, the findings confirm previous literature results for Greece, highlighting the importance of direct experience and the significance of how individuals interpret or perceive extreme phenomena, as well as the interplay with climate change perceptions [2,21]. The results of this study constitute a unique piece of the puzzle on the understanding of the above relationships and the interplay between environmental sensitivity and climate change risk perception for the country as well as the Eastern Mediterranean region. The prior graph (Figure 4) summarizes the main associations found in the present study.

Previous direct experience of a climate-related natural disaster was found to be connected with the NEP mean score of the respondents, showing that individuals who have such an experience tend to be more ecologically sensitive. Previous literature supports this finding, indicating that experiences of tragic events can influence environmental concerns and sensitivity [52]. This is also in agreement with the conclusions of Rudman et al., [23] who found that previous direct experience with extreme weather can increase pro-environmentalism as expressed by voting intentions of citizens.

Nevertheless, variations in the influence on the environmental views can be expected depending on how powerful and direct the experience of a disaster was for each individual, as described by Marshall et al. [73]. Thus, it would be useful for future research to break down the views depending on the exact experiences and their intensity for the participants,

as well as the location and directness of these experiences (also found to play a role in Brody et al. [12]) to examine potential differences.
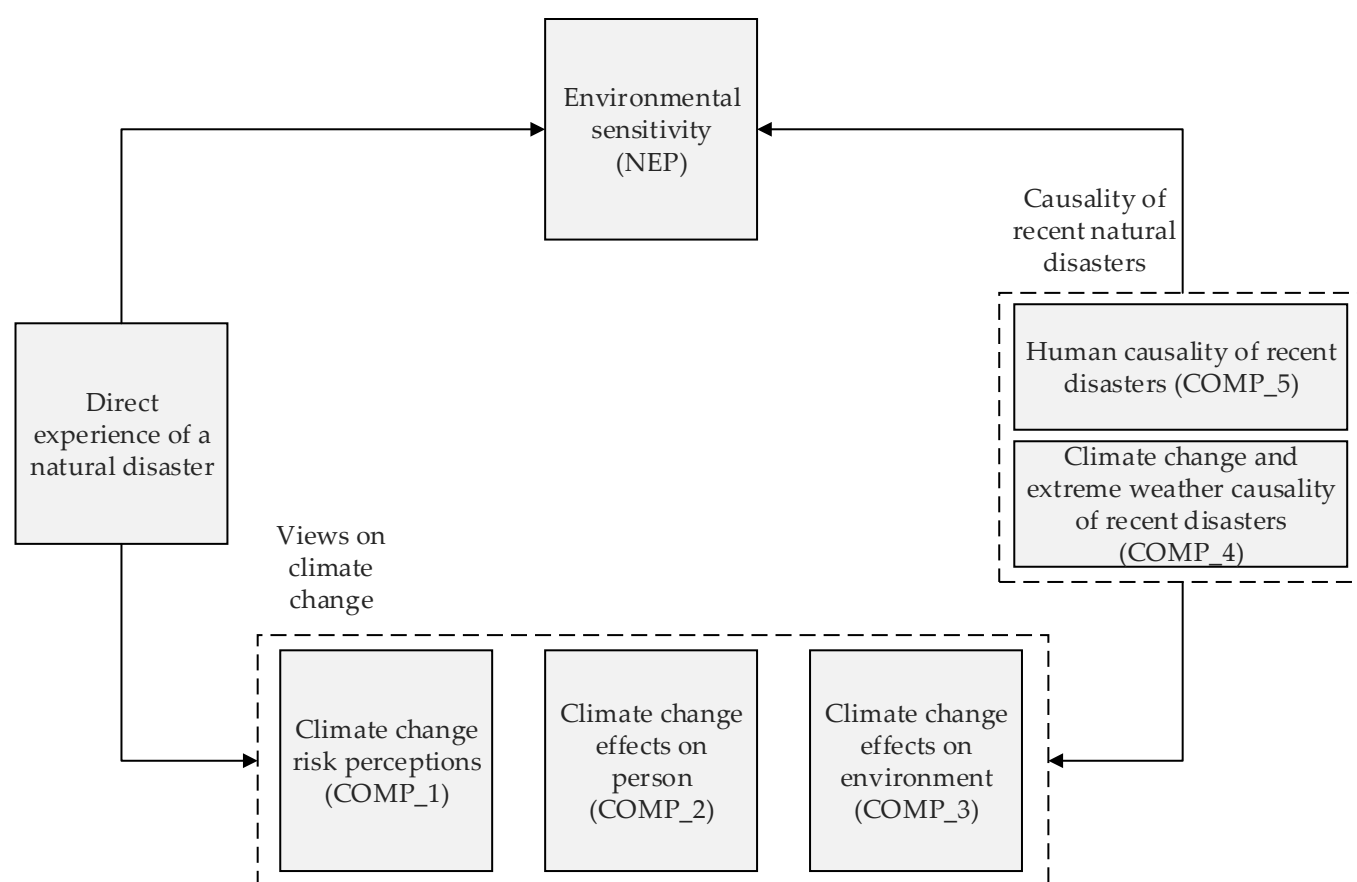
Figure 4. Summary of results showing main associations between the examined parameters.

Furthermore, the findings regarding the influence of previous experience of climate-related disasters on perceptions and views of climate change are in agreement with most of the literature both in the field or risk perception [11,13,17–20] and in the area of other beliefs [35]. These connections could be attributed to the fact that previous direct experiences create an affective response in individuals, which is a well-established concept [26,74]. This occurs through various mechanisms, including elicitation of strong emotions, which make such events memorable [75], as well as experiencing personal consequences of disasters [55], having personal relevance [21] and others. Previous studies [20,22,26] show that experiencing the effects of global warming in the form of extreme events can be one of the strongest predictors compared to other influencing factors in risk perception of climate change, supporting the findings of the present study.

Participants' views on recent notable climate-related disasters in the country were found to be connected positively with environmental sensitivity. In addition, their views on these recent disasters were associated with their beliefs regarding climate change, including risk perception and its effects on themselves and the environment. This is in agreement with previous studies which link events and environmental changes with climate change perceptions [11]. It has to be noted that answers to the questions regarding the cause of local climate-related disasters show that a large number of participants consider the human factor more important than climate change and extreme weather. This is in line with the findings of Diakakis et al. [41] for Greece and other works [76], which show that a part of the public believes that these events are caused primarily by human intervention rather than natural processes. The results show that people with higher NEP score attribute to the human factor a great deal of influence on these climate-related disasters. It is possible that

the media and other sources have played a role in the attribution of the main cause of these events to climate change or to human factors by the public.

With regard to the correlation between climate change risk perception and the NEP scale's mean score, the results support literature findings [12,77], which suggest that worldviews are an important predictor of risk perception. Previous studies showed that stronger ecological sensitivity leads to higher risk perception associated with climate change [12]. Specifically, stronger pro-environmental views have been linked with concerns and even distress regarding risks connected with climate change [33] and have been positively associated with climate- and environment-related risk perception [32,78] and even attitude change [79]. The negative implication of this association may be that it leads to the conclusion that to change people's opinions about the risks of climate change, it may be necessary to try to change their deeply-held worldviews and views on the environment, which in turn may be a difficult task [80]. Nevertheless, influences can be multidirectional. Based on present data, it cannot be certain whether strong pro-environmental views among participants have influenced their risk perceptions of climate change, or vice versa.

With respect to practical implications, given that experiences of climate change for most people are indirect, authorities should exploit the occurrence of extreme weather and climate-related disasters in their educational and informational programs to remind people of the threat of climate change in the form of "teachable moments" (as suggested by Zanocco et al. [28]). In this way, they would be exploiting, in essence, the affective experience of members of society, transferred to the general public through the images published by the media (especially in tragic events) and their power of persuasion [31,81]). In particular, practitioners (including civil protection officials and risk professionals) can engage in communication of risks through images of extreme events, maps and storytelling, which have the potential to capitalize on the affective side of experiential learning [82,83]. Pairing media with community leaders' support in climate change initiatives is capable of prolonging and enhancing their influence [31]. Authorities and community leaders, in the post-disaster period, should remind people that climatic change has the potential to lead to higher frequencies of such events in their area in the near future. This can be achieved by setting up campaigns to inform the public about personal and community protective measures to mitigate risks, as well as existing and future climate-protective initiatives and policies. Previous research has shown that, especially in the locations that have experienced these extreme events, informational campaigns and adaptation efforts can be most effective [17]. According to Myers et al. [13], people who are not engaged in climate change issues may become more involved after experiential learning or actual direct experience. However, a bidirectional influence cannot be ruled out as people already engaged may see experiences of disasters as a result of climate change to a stronger degree [13]. Furthermore, including and keeping people at the center of risk mitigation initiatives, climate tools and strategies may also have a positive influence in connecting laymen with the notion of continuous efforts towards risk reduction and the concept of expected threats and preparedness associated with climate change [84–86].

Nevertheless, the influence of extreme events on peoples' opinions on climate change appears to have an upper limit, especially when not accompanied by carefully planned campaigns [31]. Individuals can attribute local climate-related disasters to local human interventions and authorities' competence [87], indicating the existence of a limit in the usefulness of such events in educating the general public on climate change (as suggested by Whitmarsh [27]). Despite these limitations, Carlton and Jacobson [32] found that communicating risks can be a stronger and more convincing argument to laymen than talking about general climate change adaptation. In addition, using risks or previous disasters with proximity to the audience could benefit the strength of the message as shown in previous studies [88]. Further, it has to be noted that the results have to be considered with caution when it comes to their transferability, as cultural, social and environmental factors may differentiate some of the associations identified in the present data, limiting the generalizability of the findings. In this sense, future research should

continue to collect similar information across data-poor regions to acquire a more complete and detailed understanding of how the population perceives the pressing threat of climate change. Surveys before and after important disasters are also useful to better understand the dynamic nature of the relationships explored in the present study as well as the role of demographics in shaping the examined views.

Overall, the findings of this study support the concept of the influential role of experience, which is, in essence, a source of experiential information and a powerful tool, capable of enhancing pro-environmental views and risk perception for climate change, overcoming political ideologies and other social constructs [26].

5. Conclusions

Understanding public perceptions of climate change risks and environmental views is a key piece of knowledge necessary for effective communication, mitigation and adaptation initiatives. This work contributes to the growing literature on risk perception of climate change and the role of natural hazards by adding a piece of new knowledge in the climate-sensitive and relatively data-poor region of the Eastern Mediterranean. The study examines the relationships between the views of people on climate change in Greece, their environmental values and their opinions on the causes of recent notable disasters in the country, as well as direct disaster experience.

The results show that individuals with direct disaster experience related to climate or people who attribute previous catastrophic events to climate change are more likely to be concerned about climate change risks and its effects. Both direct experience and their views on the causes of recent disasters show positive correlations with environmental sensitivity (as expressed by NEP mean score) and climate change views. These findings establish a strong connection between the occurrence of natural disasters related to climate and the views of the population on climate change and their environmental values, supporting previous research findings.

Apart from providing a piece of the knowledge puzzle for a region that is to a great extent unexplored, the main practical implications of the findings lie in highlighting the importance of the role of experience and perception of extreme events. By making reference to climate-related disaster experiences and to recent notable events, authorities and community leaders may communicate more effectively the risks of climate change to the general public.

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Appendix A

Table A1. NEP scale's components.

	Components				
	1	2	3	4	5
We are approaching the limit of the number of people the earth can support	0.780				

Table A1. *Cont.*

	Components				
	1	**2**	**3**	**4**	**5**
The Earth has plenty of natural resources if we just learn how to develop them	0.716				
The Earth is like a spaceship with very limited room and resources	0.639				
Humans have the right to modify the natural environment to suit their needs		0.833			
Plants and animals have as much right as humans to exist		0.643			
Humans were meant to rule over the rest of nature		0.809			
When humans interfere with nature it often produces disastrous consequences			0.543		
The balance of nature is strong enough to cope with the impacts of modern industrial nations			0.517		
The balance of nature is very delicate and easily upset			0.714		
Human ingenuity will ensure that we do not make the earth unlivable				0.664	
Despite our special abilities, humans are still subject to the laws of nature				0.819	
Humans are severely abusing the environment				0.675	
Humans will eventually learn enough about how nature works to be able to control it					0.714
The so-called "ecological crisis" facing humankind has been greatly exaggerated					0.584
If things continue on their present course, we will soon experience a major ecological catastrophe					0.813

Table A2. Risk perception of climate change and natural disasters components.

	Components				
	1	**2**	**3**	**4**	**5**
Climate change is an issue that is affecting or is going to affect me personally	0.736				
The issue of climate change is an issue of high importance to me personally	0.795				
I am concerned about natural hazards/environmental risks derived from climate change	0.632				
Climate change frightens me	0.643				
Climate change does not exist	−0.683				
Climate change will have a noticeably negative impact on my health		0.661			
Climate change will have a noticeably negative impact on my financial situation		0.611			
Climate change will have a noticeably negative impact on the environment in which my family and I live		0.631			
Climate change may lead to changes in weather patterns and extreme weather events			0.776		

Table A2. *Cont.*

	Components				
	1	2	3	4	5
Climate change may lead to increased flood frequency			0.808		
Climate change may lead to sea level rise and loss of land			0.835		
Climate change will lead to a global catastrophe			0.744		
Climate change will affect the occurrence of natural disasters			0.701		
The flood in Mandra (2017), the wildfire in Mati (2018) and the tornado in Halkidiki (2019) are a result of climate change				0.736	
The flood in Mandra (2017), the wildfire in Mati (2018) and the tornado in Halkidiki (2019) are related to extreme weather				0.878	
The flood in Mandra (2017), the wildfire in Mati (2018) and the tornado in Halkidiki (2019) are a result of human intervention					0.809
The flood in Mandra (2017), the wildfire in Mati (2018) and the tornado in Halkidiki (2019) are related to the operation of the state mechanism					0.875

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