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Understanding the role of hope in climate change risk perception: a cross-sectional study

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ABSTRACT

Italy is experiencing the negative effects of climate change, which is causing considerable damage. Evidence of the damage is increasing citizens' concern about climate change. According to many researchers, investigating the factors that drive and shape risk perception of climate change is of paramount importance to predicting public willingness to help combat it. Recently, the Climate Change Risk Perception model (CCRPM) was validated, showing its efficacy. However, the CCRPM does not consider some psychological variables related to people's confidence that climate change can be mitigated. The purpose of the present study is to replicate CCRPM in the Italian context and to shed light on whether the addition of the Climate Change Hope variable can improve the explanatory power of this model. Results indicate that the CCRPM explains 49% of the variance of climate change risk perception and the addition of Climate Change Hope improves the model. Knowledge of impacts of climate change, social norms, value orientations, affect, and personal experience with extreme weather events were all identified as significant predictors. Affective and social norms factors explained significantly more variance in risk perception than other variables. These results suggest that climate change risk perception is a complex and multidimensional construct and that risk communicators should take an integrative approach by stimulating citizens' affective and experiential processing mechanisms.

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Climate change; Health psychology; Risk perception; Psychological determinants; Pro-environmental behavior

1. Introduction

Italy, like many other countries, is experiencing the negative effects of climate change, which are causing considerable damage and expense to the country (Ciervo et al. 2017). Indeed, climate change is contributing to several extreme events, such as precipitation (Forestieri et al. 2018), landslides (Ciabatta et al. 2016), and droughts (Bo et al. 2020). Moreover, due to rising temperature and reduced precipitation, climate change is expected to have a strong impact on

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agricultural production, especially in Southern Italy (Van Passel, Massetti, and Mendelsohn 2017; Bozzola et al. 2018). The tourism sector is also being affected by climate change. Summer destinations are being affected by lengthier dry seasons and reduced availability of water resources (Köberl, Prettenthaler, and Bird 2016), and mountain destinations are being affected by inconsistent snowfall and rising temperatures (Pede et al. 2022).

Experiencing or hearing about these various manifestations of the havoc climate change is increasing citizens' concern about climate change and the perceived risk to the planet and their land (Antronico et al. 2020). Indeed, according to a study by the European Commission, Italians and others European respondents consider 'global warming/climate change' as one of the most serious problems along with 'poverty, hunger and lack of drinking water, and armed conflicts' (European Commission 2021). This subjective assessment and evaluation of the potential risks associated with climate change events, which is not necessarily related to the objective level of risk, is referred to as 'risk perception'. It involves a combination of cognitive, emotional, and social factors that influence how people perceive and respond to risks. Since many studies indicate that risk perception is an important predictor of public willingness to help reduce climate (Spence et al. 2011; Tobler, Visschers, and Siegrist 2012), a more detailed understanding of the psychological factors that drive and shape risk perception of climate change is of paramount importance.

More in detail, risk perception refers to the subjective process of discerning and interpreting signals regarding uncertain events and forming a subjective judgment of the potential negative consequences associated with these events (Maartensson and Loi 2022; Ostrom and Wilhelmsen 2019; Bradley et al. 2020). Knowledge, expertise, personal values, attitudes, and emotions collectively shape individuals' assessments of risk. In the realm of social sciences, the term 'risk perception' has become conventional terminology (Slovic 1992). However, unlike tangible phenomena perceived through the human senses, risks cannot be directly sensed. Instead, people rely on mental models and various psychological mechanisms, such as cognitive heuristics and risk imagery, acquired through social and cultural learning. These mechanisms are continuously influenced by media coverage, peer interactions, and communication channels, leading to their constant modification or reinforcement (Morgan 2002).

Moving to risk perception specifically related to climate change, it can be defined as the cognitive and emotional evaluation that individuals or communities make regarding the potential hazards, consequences, and uncertainties associated with climate-related events and phenomena (Van der Linden 2017). It encompasses the recognition of various climate-related risks, such as extreme weather events, sea-level rise, biodiversity loss, and impacts on human health and socio-economic systems. As with perceived risk in general, perceived risk concerning climate change is influenced by factors such as knowledge, beliefs, values, past experiences, cultural norms, media coverage, and communication channels (Van der Linden 2017). Consequently, the definition of the climate change-related risk perception construct is conceptually independent of the specific type of climate hazard being evaluated (e.g. heat waves, drought, flooding, storms), and the psychological determinants that characterize the risk perception of these extreme events are the same (Wachinger, et al. 2010). These commonalities allow for the generation and measurement of the climate change-related risk perception construct that encompasses these catastrophic events.

However, upon reviewing the literature on risk perception, a significant deficiency in theoretical integration has been observed, with many of the dimensions mentioned earlier often examined in isolation (Af WÅhlberg 2001; Van Der Linden 2015). In many ways, the field has become increasingly contested from a theoretical standpoint (Moser 2016), with scholars holding differing views on the diverse methodologies employed in studying risk perception (Van der Linden 2016). This complexity complicates the task of comprehensively assessing the field. In order to foster and encourage additional theoretical advancements in the literature, Van Der Linden (2015) validated the climate change risk perception model (CCRPM). It identifies four

key dimensions as antecedents of this phenomenon: 'socio-demographic', 'cognitive', 'experiential', and 'socio-cultural' factors. Specifically, socio-demographic characteristics include age, gender, education, income, and level of religiosity; cognitive variables include people's knowledge about the causes, impacts, and effective responses to climate change; experiential factors include affect and personal experience with extreme weather events. Affect involves people's perception of climate change as pleasant or unpleasant, while personal experience pertains to whether participants have experienced extreme weather events in their local area in recent past years. Lastly, socio-cultural influences include the social representation of climate change, the social norms related to adaptation and mitigation actions, and the value orientations guiding an individual's worldview (Van Der Linden 2015). This model, originally tested on a representative sample in the UK, has highlighted its validity and effectiveness in predicting climate change risk perception. The results provide robust evidence for the influence of cognitive, experiential and sociocultural factors, jointly explaining nearly 70% of the variance in climate change risk perceptions (Van Der Linden 2015). Overall, experiential, and socio-cultural processes were most influential, weighing in substantially more than either cognitive or sociodemographic factors in explaining public risk perceptions of climate change (Van Der Linden 2015). This model has been validated in several countries (e.g. US, Canada, Australia, France) (Bradley et al. 2020; Wong-Parodi and Berlin Rubin 2022; Gilbert and Lachlan 2023; Xie et al. 2019; van Eck et al. 2020; Soucy et al. 2022). Specifically, the replication study by Gilbert and Lachlan (2023) supports the findings of Van Der Linden (2015), indicating that the CCRPM explains 62% of the variance in climate change risk perceptions among the general United States population. The most influential predictors were the socio-cultural factors of prescriptive norms and biospheric values. Similarly, a study by Xie et al. (2019) in Australia found descriptive norms, prescriptive norms, and biospheric values to be significant predictors, mirroring the pattern observed in van der Linden study (2015). Additionally, Xie et al. (2019) expanded the model by including predictors such as free-market ideology and beliefs about the efficacy of climate change mitigation actions, based on empirical evidence suggesting their influence climate change risk perceptions (Fielding and Head 2012; Heath and Gifford 2006; Reser, et al. 2012). Incorporating response inefficacy into the cognitive variables substantially increased the variance explained by cognitive factors from 14% in the original CCRPM model to 42% in the extended model. This suggests that individuals who perceive greater response inefficacy regarding climate change mitigation actions tend to perceive lower risk. Overall, the extended CCRPM accounted for 72% of the variance in risk perception, an improvement of 3% compared to the original model without the additional predictors. Furthermore, Soucy et al. (2022) replicated the CCRPM in the state of Maine. In their model, factors such as knowledge about the causes of climate change, personal experience, affect, and social norms were all found to be significant predictors, collectively explaining 72% of the variance in climate change risk perceptions. Similarly, van Eck et al. (2020) tested the CCPRM and found that the final model explains the 84% of the variances in climate change risk perception of audience members in the climate mainstream blogosphere. In summary, multiple studies provide robust evidence supporting the predictive power of the CCRPM across different populations and contexts.

1.1. Climate change and hope

Although the CCRPM (Van Der Linden 2015) is quite comprehensive and is a strong predictor of perceptions of climate change risk, it does not consider psychological variables related to how much people believe they can do something to mitigate climate change, which could influence the actual enactment of adaptation and mitigation behaviors. One variable of particular interest is Hope. It is important to introduce this variable into the model because 'hope' plays a role in shaping individuals' cognitive and emotional responses to climate change. Research has shown that hope can influence individuals' perceptions of future outcomes, their

motivation to engage in mitigative actions, and their overall resilience in the face of adversity (Ojala 2012). By including hope as a variable in the model, we aim to elucidate its specific contribution to climate change risk perception. Moreover, the inclusion of hope allows for a more comprehensive understanding of the emotional landscape surrounding climate change. While emotions like worry and dread may be prevalent in the face of perceived threats, hope serves as a counterbalance, offering individuals a sense of agency and possibility in addressing climate challenges (Clayton and Karazsia 2020). Indeed, according to the perspective of positive psychology, the construct of hope reflects two main components: agency and pathways. While agency refers to an individual's motivation to succeed in a specific task, pathways refer to the means through which the task can be achieved (Luthans et al. 2008; Newman et al. 2014). Therefore, hope reflects not only a general belief in one's ability to achieve outcomes but also the ability to find ways to anticipate and achieve those outcomes (Li and Monroe 2018). Therefore, the construct of Hope could play a role in determining levels of risk perception and, consequently, in the adoption of adaptation and mitigation behaviors. For example, research has shown that the consumers' choice to purchase sustainable products adhering to environmental and social standards is strongly influenced by how much consumers believe their efforts can make a difference in sustainability (Ghvanidze et al. 2016; Wang, Nguyen, and Bu 2020). Indeed, the belief that one's actions can address a problem and the availability of information about one's environmental impact can catalyze environmental behavior and ethical concerns of consumers regarding food consumption (Vermeir and Verbeke 2006). In relation to climate change, indeed, several studies have found that while people show interest in environmental issues, their belief in their ability to address them – i.e. their levels of Hope – plays a mediating role in the perception of climate change risk (Stevenson and Peterson 2015). Specifically, feeling of hopelessness can act as significant barriers to action and risk perception (Searle and Gow 2010; Torma 2020), as also showed in the CCRPM replication study by Xie et al. (2019). In particular, low levels of hope may contribute to the perception that climate change is beyond one's control and to a failure to acknowledge the impact of one's behaviors, leading to the use of coping strategies such as denying of the seriousness of the problem, and reduced commitment to mitigating climate change (Stevenson and Peterson 2015; Maartensson and Loi 2022). Therefore, the variable of Hope warrants consideration in models aimed at identifying factors influencing risk perception, alongside cognitive, experiential, and socio-cultural factors. Indeed, research in the field of pro-environmental behavior has demonstrated that Hope exerts an important influence on risk perception (MacInnis and De Mello 2005), and in particular suggested that Hope may lead to a decrease in risk perception (Biassoni, Salducco, and Abati 2022). This positive relationship between Hope and behavior is consistent with previous research suggesting that climate change hope is an antecedent to engagement with climate change solutions (Stevenson and Peterson 2015). For example, during the COVID-19 outbreak, individuals perceiving a high level of susceptibility, severity, and uncontrollability of the events related to the pandemic consumed their internal resources, leading to reduced hope and sense of mastery. High levels of risk perception made individuals more likely to believe that the epidemic was uncontrollable, resulting in a higher likelihood of being infected and experience more negative emotions (Cao et al. 2020; Ding and Li 2023; Zhuang, Jiang, and Chen 2021). Nonetheless, research provides contrasting results, suggesting that further research is needed to deepen the understanding of this relationship (Biassoni, Salducco, and Abati 2022). In order to measure the Hope variable, Li and Monroe (2018) have developed the Climate Change Hope Scale (CCHS), which captures the extent to which individuals believe that they and society in general can generate and execute ways to solve the problems caused by climate change (Li and Monroe 2018). Li and Monroe suggest that researchers in environmental psychology who use quantitative approaches to exploring climate change risk perception should consider incorporating hope in their models to better predict climate change perceptions and behavior.

Given these premises, in the present study we aim to: (1) determine whether Van Der Linden (2015) CCRPM, originally developed and validated in the UK, is replicable in the Italian context and (2) determine whether and to what extent the addition of the hope variable can improve prediction of climate change risk perception.

2. Material and methods

2.1. Sampling and materials

Data were collected *via* a questionnaire that was completed by a representative sample of the Italian population with sex, age, profession, size of the centre, and geographical area extracted by stratified sampling using quotas and weights to assure representativeness for the stratification variables. In particular, we used a stratified sampling approach to ensure that our sample accurately represented various demographic characteristics of the population such as gender, age, geographic area, inhabited centre size, and occupation. In addition, we used quotas for each identified stratum to control the composition of the sample. Once the predetermined quotas were reached, the sampling process was stopped.

In addition, to improve the similarity between our sample and the population distribution, we applied weighting techniques. These weighting adjustments allowed us to closely align the distribution of the sample with that of the population. The percentages relating to the Italian population were taken from the website of ISTAT (ISTAT) and are reported in Table 1. The survey was conducted using a CAWI (Computer Assisted Web Interviewing) methodology between 09 May 2022 and 13 May 2022. To ensure that people read the questionnaire carefully and gave reliable answers, we added a control question in the survey, keeping only participants who had correctly answered that question. The final sample consists of 1011 subjects randomly selected from the consumers' panel managed by Norstat srl (https://norstat.it/) using random digit dialling, which is a technique for drawing a sample of households from a set of telephone numbers. This study is part of a broader project ('CLIMAL') aimed at assessing the psychosocial impact of climate change and promoting citizen engagement in sustainable behaviors. This study has been performed in accordance with the Declaration of Helsinki and has been approved by an independent ethics committee of Università Cattolica del Sacro Cuore in Milan (CERPS).

The survey included (see Supplementary Material A for the complete survey guide) some validated scales as well as ad hoc items:

- *Risk perception*. Eight questions taken from the items developed by Bord, O'Connor, and Fisher (2000) and Leiserowitz (2006) were used to create a holistic assessment of risk perception, the same items used in the CCRPM (Van Der Linden 2015). These items covered both personal risk (i.e., the likelihood of personally experiencing threats to general well-being due to climate change) and global risk (i.e., the likelihood that society would be threatened by climate change). For analysis, the holistic risk index was considered, which is the sum of personal risk and global risk.
- *Knowledge about climate change*. Three different types of knowledge were assessed: knowledge regarding the causes of climate change, the consequences of climate change, and ways to mitigate climate change. Knowledge regarding causes was assessed with 12 items in which participants were asked to rate the contribution (major, minor, none) of different factors to climate change. Knowledge regarding the consequences of climate change was assessed by asking respondents to estimate the extent to which 10 different phenomena (e.g., global sea level) were likely to increase, decrease, or not change at all as a result of climate change. Finally, respondents were asked 11 questions assessing their knowledge of ways to reduce climate change. Responses were dichotomized as either right (1) or wrong (0) and scored based on the number

Table 1. Demographic profiles of the sample ($n = 1011$).

	n	% Weighted	% Unweighted	% Population
1. Gender				
Male	498	49.3	49.8	49.3
Female	513	50.7	50.2	50.7
2. Age				
18–24	102	10.1	9.8	10.0
25–34	165	16.3	16.4	16.3
35–44	217	21.5	21.3	21.5
45–54	229	22.7	22.3	22.7
55–59	109	10.8	11.6	10.8
60–72	189	18.7	18.7	18.8
3. Education				
Elementary/Middle school	190	18.8	18.7	–
High school	576	56.9	56.9	–
College or university	245	24.3	24.4	–
4. Geographic area (Italy)				
North-West	266	26.3	25.3	26.3
North-East	188	18.6	18.7	18.6
Centre	199	19.7	20.4	19.7
South and Islands	358	35.4	35.6	35.5
5. Inhabited centre size				
Until 10000 inhabitants	312	30.8	32.0	32.1
10/100.000 inhabitants	445	44.0	43.2	44.0
100/500.000 inhabitants	110	10.9	10.7	10.9
More than 500.000	131	13.0	12.7	12.9
I do not know	13	1.3	1.4	–
6. Profession				
Entrepreneur / freelancer	125	12.4	12.5	12.4
Manager / middle manager	38	3.8	1.9	3.8
Employee / teacher / military	194	19.2	19.9	19.2
Worker / shop assistant / apprentice	212	21.0	21.3	21.0
Housewife	152	1.0	14.9	15.0
Student	54	5.3	6.5	5.3
Retired	80	7.9	6.2	7.9
Unoccupied	156	15.4	16.8	15.4
7. Household net monthly income level				
Until 600 €	121	12.0	12.8	–
601–900 €	78	7.8	8.0	–
901–1200 €	130	12.8	12.5	–
1201–1500 €	175	17.3	17.1	–
1501–1800 €	100	9.9	9.7	–
1801–2500 €	118	11.7	11.4	–
2501–3500 €	59	5.9	5.7	–
More than 3501 €	46	4.5	4.1	–
Missing	184	18.2	18.8	–

of correct answers, where more correct answers indicate a higher knowledge score (references and method adopted from Leiserowitz, Smith, and Marlon (2010)). The reliability of these questions was evaluated by academic climate scientists (Van Der Linden 2015).

- *Engagement in sustainable development*. Engagement in sustainable development was measured with the Engagement/Disengagement in Sustainable Development Inventory (EDiSDI), which was validated by Moreira, Ramalho, and Inman (2021) and contained 27 items grouped into two general factors (engagement and disengagement) and six specific factors. We utilized only the factor called 'emotional engagement', which was measured with four items. A higher score on this scale indicates positive affective reactions toward sustainable development and sense of connectedness with sustainable development.

Participants responded to all items on a 5-point scale (1 = completely false; 5 = completely true).

- *Personal experience with extreme weather events*. Participants were asked to report how many times in the past year they had experienced extraordinary weather events (e.g., water bombs, floods, landslides, tornadoes). This measure was adapted from Van Der Linden (2015).
- *Value orientation*. The measure of value orientation was based on previous work by Schwartz (1992), Stern et al. (1999), and De Groot and Steg (2007). A standardized scale was developed to measure two different types of values, namely, socio-altruistic and biospheric values. Respondents were asked to evaluate the importance of 8 values 'as guiding principles in their lives' on a 9-point scale, ranging from opposed to my values (1), to extremely important (9).
- *Social norms*. Two different types of social norms were evaluated: Descriptive norms that assessed how important is for participants that important referents for them are taking personal action to help combat climate change, and prescriptive norms were assessed with items measuring the extent to which participants feel socially pressured to personally help reduce the risk of climate change. Participants responded on a 7-point Likert-scale ranging from completely disagree (1) to completely agree (7). These items were taken from the study of Van Der Linden (2015).
- *Climate change hope*. Climate change hope was evaluated using the Climate Change Hope Scale (CCHS) that was validated by Li and Monroe (2018). It is composed of 11 items grouped into three factors: (a) collective-sphere willpower and waypower, (b) personal-sphere willpower and waypower, and (c) lack of willpower and waypower. The design of the scale is based on hope theory (Snyder 1995), a framework in which willpower and waypower are deemed applicable in solving environmental issues. Willpower refers to the extent to which individuals believe they are able to meet the life goals they set for themselves; waypower measures the extent to which individuals can think of ways to overcome a problem (Li and Monroe 2018). Since the Snyder State Hope Scale (Snyder 1995) presents a limitation in the context of global environmental problems since it measures personal-sphere of willpower and waypower, the CCHS (Li and Monroe 2018) also includes collective-sphere willpower and waypower. High scores on the first factor indicate that people are confident that negative effects of climate change can be reversed, as they believe that others (e.g., scientists) will solve the problem; those who have high scores on waypower have confidence that negative effects of climate change are reversible because they believe that they as citizens can do something to solve the problem; those who have high scores on the third and last factor believe that it is not possible to solve problems concerning climate change. All items were assessed on a 7-point Likert scale ranging from 1= completely disagree to 7 = completely agree. In order to get more reliable answers, the questions related to this scale were filtered for those who considered that the climate is changing. This scale has been used and validated in previous studies involving samples of adults, showing good validity relative to the general scale ($\alpha = .74$) (Çıplak 2022).

Finally, responses to a series of questions regarding participants' socio-demographic profile (gender, age, profession, geographical area, inhabited center size, monthly net family wage and level of education) were collected.

All scales included are the same used in the climate change risk perception model (CCRPM) Van Der Linden (2015), except for the Engagement Scale in Sustainable Development (Moreira, Ramalho, and Inman 2021), which was substituted for the Holistic Affect Scale (Peters and Slovic 2007), and the Climate Change Hope Scale (CCHS) (Li and Monroe 2018), which was included in the present study but not originally included in the CCRPM model.

2.2. Data analysis

Data were analyzed using descriptive statistics and calculating frequencies, percentages, averages, and standard deviations for each variable measured, considering the total sample ($n = 1011$). After that, hierarchic regression analysis was conducted. The latter analysis was carried out on 829 subjects; 163 were eliminated because (i) in response to the question related to personal experience, they did not remember how many extreme climatic events had experienced and (ii) they did not perceive that the climate is changing and therefore did not answer all scales. In addition, another 19 subjects were eliminated after testing various indexes to verify the main assumptions to produce a reliable regression model. The data were tested for normality test, autocorrelation, and multicollinearity test. To pass these tests, data need to be normally distributed and have no autocorrelation and multicollinearity (for more details see Supplementary Material B). Finally, the reliability of the scales used in the regression model was analyzed, using Cronbach's alpha values. Scales with Cronbach's alpha values greater than 0.70 were considered reliable, as suggested by Hundleby and Nunnally (1968) (Supplementary Material B presents a table showing the correlations between all variables entered into the model).

The hierarchical regression model was tested following the theory-based approached used to test the CCRPM model, namely, overall perception of the risk of climate change was the dependent variable, and the various independent variables were examined using stepwise entry. In the first block, the socio-demographic characteristics were added. In particular, age, religiosity, gender (1= male; 2= female), level of education (1= non-graduates; 2= graduates), and income (1= below 1500€; 2= above 1501€) were considered. Missing values on the income question were replaced with median values and categorized as previously indicated. Subsequently, in the second block, the questions regarding the cognitive dimension, namely knowledge about causes, impact of, and responses to climate change were inserted. The third block is related to the experiential dimension that groups questions regarding emotion engagement regarding climate change and personal experience with extreme weather events. The personal experience responses were combined and dichotomized to form an index describing personal experience (0= no experience, 1= experience). The fourth block reflects the social-cultural dimension, including questions related to social norms and value orientations. Finally, the fifth block includes questions related to the hope that negative effects of climate change can be reversible. This last variable was not included in the original CCRPM. This last block of questions was included to understand the extent to which the addition of this scale could improve the model proposed by Van Der Linden (2015). To assess how well the regression model fits the data, the coefficient of determination R2, the Adjusted R2 and the F-statistics were calculated. In addition, to test the regression coefficients, the unstandardized regression coefficients β were considered, with statistical significance set at $p < .05$. All analyses were carried out with IBM SPSS 20 (release 20.0.0.0).

3. Results

3.1. Description of the sample

The sample is composed of 1011 people of which 498 (49.3%) are male and 513 (50,7%) are female, aged between 18 and 72 years ($M = 46.69$, SD = 13.8). The demographic profile of the sample is presented in detail in Table 1.

3.2. Descriptive statistics

As shown in Table 2, most of the Italian population has a high perception of risk related to climate change (79.5%), while only 6.2% perceive low risk. In particular, while a great portion

of Italian population (44.2%) is highly familiar with the consequences of climate change, only 1% has high knowledge of the causes of climate change, and only 0.8% is highly aware of the responses-behaviors that can mitigate it. Italians also reported that they are strongly emotionally involved with sustainable development issues (81.3%) and 70% said they have personally experienced an extreme weather event in the last year. 61% of Italians know people who encourage them to implement sustainable behaviors, while only half of the sample (50.6%) know people who implement environmentally protective behaviors.

Finally, most Italians claimed to have values that lead them to respect each other (80.1%) and respect the planet (81.8%), and they have a positive attitude toward the possibility of changing the future of our planet from a climate perspective, mainly because they believe that people, in the first instance and in their personal-sphere activities, can do something to improve this situation (74.2%).

3.3. Hierarchical regression model

After testing the assumptions about the regression model (see Supplementary Materials B) the hierarchic regression model was tested. Table 3 presents the main results of this analysis. The regression model tested the impact of socio-demographics (sex, age, level of education, income, and religiosity), cognitive factors (knowledge about causes, impacts and responses of climate change), the experiential dimension (emotional engagement towards the climate change issue and the personal experience with extreme weather events), social-cultural factors (social norms and value orientations), and psychological factors (climate change hope) on perception of climate change risk. The variables inserted in the model explain 49.8% of risk perception. Emotional engagement with climate change and the descriptive social norms are the variables that most impact risk perception. In addition, knowledge of the impacts of climate change, socio-altruistic values, and personal experience positively affect perceptions of risk, while lack of hope in reversing climate change effects negatively impacts on it. However, the socio-demographic variables, knowledge of causes of climate change and response-behaviors, prescriptive social norms, biospheric variables and personal/collective hope do not affect the holistic risk perception of climate change.

4. Discussion

Perception of climate change risk is clearly complex and multidimensional. The purposes of this study were to test the predictive value of the climate change risk perception model (CCRPM, Van Der Linden 2015) with a representative national sample of the Italian population and to determine whether the addition of the Hope variable, not included in the original CCRPM, could improve prediction of climate change risk perception.

We found that Italians have a high perception of risk related to climate change and they are highly familiar with the impacts that might result from it. However, they have little knowledge of the causes of climate change, and little awareness of the behaviors that can mitigate it. Moreover, Italians are strongly emotionally involved with the sustainable development issue, and they have personally experienced at least one extreme weather event in the last year. These results for subjective perception are in line with previous studies showing that climate change had negative consequences in Italy, causing damage in various sectors, especially agricultural production and tourism (Van Passel, Massetti, and Mendelsohn 2017; Bozzola et al. 2018; Köberl, Prettenthaler, and Bird 2016; Pede et al. 2022). This has led people to become increasingly familiar with these phenomena, which are experienced frequently, increasing their emotional involvement (Antronico et al. 2020; Nanni et al. 2021). Moreover, a third of the sample feels that climate change is irreversible and there is nothing people can do to change this situation.

Table 2. Descriptive statistics about orientation towards climate change.

	n	%	Mean (±SD)
Holistic risk perception (*n* = 1011)			5.34 (±1.19)
Low *(1–3)*	63	6.2	
Medium *(4)*	144	14.2	
High *(5–7)*	804	79.5	
Knowledge (*n* = 1011)			
Knowledge cause (min. 0 max 11)			4.44 (±1.49)
Low *(0–3)*	202	19.9	
Medium *(4–7)*	799	79.0	
High *(8–11)*	10	1.0	
Knowledge impact (min. 0 max 10)			6.44 (±2.42)
Low *(0–3)*	140	13.8	
Medium *(4–7)*	425	42.0	
High *(8–10)*	447	44.2	
Knowledge response (min. 0 max 10)			4.21 (±1.60)
Low *(0–3)*	259	25.6	
Medium *(4-7)*	744	73.6	
High *(8–10)*	8	0.8	
Engagement scale in sustainable development (*n* = 1011)			4.08 (±0.76)
Low *(1–2)*	23	2.3	
Medium *(3)*	166	16.4	
High *(4–5)*	822	81.3	
Personal experience with extreme weather events (*n* = 1011)			
Never	209	20.6	
Once	215	21.2	
Twice	251	24.9	
More than two times	240	23.7	
Do not remember	97	9.6	
Social norms (*n* = 1011)			
Descriptive norm			4.43 (±1.39)
Low *(1–3)*	209	20.7	
Medium *(4)*	291	28.8	
High *(5–7)*	511	50.6	
Prescriptive norm			4.71 (±1.09)
Low *(1–3)*	82	8.1	
Medium *(4)*	312	30.9	
High *(5–7)*	617	61.0	
Values orientations (*n* = 1011)			
Socio-altruistic values			7.68 (±1.46)
Low *(1–3)*	9	0.9	
Medium *(4-6)*	193	19.1	
High *(7-9)*	809	80.1	
Biospheric values			7.73 (±1.53)
Low *(1-3)*	8	0.8	
Medium *(4–6)*	175	17.3	
High *(7–9)*	827	81.8	
Climate change hope (*n* = 938)			
Collective-sphere willpower and waypower			4.84 (±0.97)
Low *(1–3)*	66	7.0	
Medium *(4)*	275	29.3	
High *(5–7)*	598	63.7	
Personal-sphere willpower and waypower			5.24 (±1.07)
Low *(1–3)*	47	5.0	
Medium *(4)*	195	20.8	
High *(5–7)*	697	74.2	
Lack of willpower and waypower			3.57 (±1.42)
Low *(1–3)*	415	44.3	
Medium *(4)*	284	30.2	
High *(5–7)*	239	25.5	

Note: (1) SD = Standard Deviation; (2) the numbers in brackets in italic represent the points of Likert scale that were grouped together.

This perception of hopelessness, perhaps driven by media communication that highlights the major problems related to climate change, makes people feeling a strong sense of impossibility to do something to mitigate the consequences of climate change (Pongiglione 2011), which might result in denial coping strategies and avoidance of thinking about the problem due to it being perceived as unsolvable, and thus in the lack of implementation of adaptation and mitigation behaviors.

Regarding the first objective of this study, that is, the replication of the Van Der Linden (2015) CCRPM model in an Italian context, some differences could be detected. Van Der Linden (2015) tested the model in the UK and found that it explained 68% of the total variance in climate change risk perceptions, while the same model accounted for 49% of the variance in our study. This difference in variance prediction is likely because some variables (gender, cause-knowledge, and response-knowledge) that are significant predictors in the model tested on UK population are not significant in the Italian sample. This result underlines potential cultural differences between countries related to variables that might have an impact on climate change risk perceptions (Maartensson and Loi 2022).

Our study shows that emotional engagement, that is, experiencing positive emotions related to sustainable development and having a sense of connection to it, is the most influential factor that contributes to determining climate change risk perception in the Italian context. This result is in line with findings in other studies showing that emotions are a major determinant of risk perception (Lerner and Keltner 2001). Moreover, having perceptions that significant others are doing something to counteract climate change (descriptive norms) also contributes to perceived risk. Indeed, accordingly to Xie et al. (2019), descriptive norms are predictors of risk perception: in their studies they showed that descriptive norms were a stronger predictor than prescriptive norms (individuals' perception of being socially pressured to personally help reducing the risk of climate change). In addition, among the different types of knowledge measured (knowledge of causes, impacts, and responses), only knowledge of the impacts of climate change turned out to be a significant predictor of perceived risk. Therefore, communications addressing climate change risk perception should primarily focus on increasing knowledge about the impact climate change could produce. Moreover, the direct experience of extreme weather events related to climate change (personal experience) contributes significantly to risk perception. This result is consisted with those found by Frondel, Simora, and Sommer (2017), showing a higher level of risk perception when individuals experience natural disasters, particularly if the event involves damage to their own property or other aspects of their well-being (e.g. injuries). Finally, referring to the value dimension, only social-altruistic values are significant predictors of perceived risk. Indeed, people's orientation towards the common good, in terms of providing necessities for all and wellbeing for any individual in the society, has been found to be the antecedent of several prosocial behaviors (Castiglioni, Lozza, and Bonanomi 2019).

Considering the revised model, the results showed how the addition of psychological variables (CCHS) enables the model to account for almost 50% of the variance, improving the predictivity of the original Van der Linden's CCRPM—at least in the Italian context. In particular, the perception of 'lack of hope' (the belief that one is not able to solve the problem) might lead to the implementation of risk denial coping strategies, thus decreasing the perception of risk itself. This result is consistent with previous research on the role of Hope in determining pro-environmental behaviors, showing that when individuals perceive climate change as beyond their control, they may cope by denying the seriousness of the problem (Stevenson and Peterson 2015). One possible explanation may be that the decrease in risk perception works as a defence mechanism. Indeed, the feeling of hopelessness, by lowering the level of perceived risk, leads individuals to 'defend' themselves against the perception of being unable to face and solve the problem. Moreover, Ojala (2012) and Hornsey and Fielding (2016) found that Hope based on denial is negatively correlated with pro-environmental behaviors. The depiction by the media of climate change focusing on the negative impact it may produce, and highlighting pessimistic

Table 3. Hierarchical regression analysis of holistic risk perception of climate change ($n = 829$).

	Model 1			Model 2			Model 3			Model 4			Model 5		
Variable	B(se)	β	p-value	B(se)	β	p-value	B(se)	β	p-value	B(se)	β	p-value	B(se)	β	p-value
Gender	0.198 (0.070)	0.097	0.005	0.232 (0.065)	0.114	0.000	0.13 (0.055)	0.064	0.019	0.103 (0.053)	0.05	0.052	0.094 (0.052)	0.046	0.074
Education	.033 (0.083)	0.014	0.695	−0.056 (0.077)	−0.023	0.471	−0.074 (0.065)	−0.031	0.253	−0.056 (0.061)	−0.023	0.365	−0.044 (0.061)	−0.018	0.477
Age	0.012 (0.003)	0.158	0.000	0.007 (0.002)	0.1	0.002	0.002 (0.002)	0.028	0.318	−0.002 (0.002)	−0.026	0.332	−0.002 (0.002)	−0.031	0.259
Income	0.029 (0.077)	0.013	0.707	0.002 (0.072)	0.001	0.983	0.045 (0.061)	0.021	0.458	−0.008 (0.058)	−0.004	0.89	0.004 (0.058)	0.002	0.951
Religiosity	0.000 (0.011)	0.001	0.983	0.014 (0.011)	0.043	0.186	0.011 (0.009)	0.033	0.23	−0.003 (0.008)	−0.01	0.712	−0.002 (0.008)	−0.007	0.782
Knowledge impact				0.139 (0.017)	0.300	0.000	0.08 (0.015)	0.174	0.000	0.069 (0.014)	0.148	0.000	**0.066 (0.014)**	**0.143**	**0.000**
Knowledge response				0.081 (0.026)	0.119	0.002	0.049 (0.022)	0.072	0.024	0.033 (0.021)	0.048	0.111	0.026 (0.021)	0.038	0.211
Knowledge cause				0.034 (0.026)	0.047	0.183	0.009 (0.022)	0.012	0.688	0.009 (0.021)	0.012	0.678	0.009 (0.02)	0.013	0.653
Engagement							0.753 (0.043)	0.506	0.000	0.448 (0.054)	0.301	0.000	**0.443 (0.055)**	**0.298**	**0.000**
Personal experience							0.281 (0.067)	0.114	0.000	0.269 (0.063)	0.109	0.000	**0.259 (0.063)**	**0.105**	**0.000**
Descriptive norm										0.183 (0.022)	0.242	0.000	**0.192 (0.022)**	**0.254**	**0.000**
Prescriptive norm										0.036 (0.031)	0.037	0.242	0.016 (0.033)	0.016	0.631
Biospheric values										0.073 (0.036)	0.096	0.043	0.069 (0.036)	0.092	0.054
Socio-altruistic values										0.095 (0.035)	0.122	0.006	**0.096 (0.035)**	**0.123**	**0.006**
Personal hope													0.023 (0.037)	0.023	0.54
Collective hope													−0.056 (0.035)	−0.051	0.111
Lack of hope													**−0.061 (0.02)**	**−0.085**	**0.003**
Constant	4.545 (0.213)		0.000	3.342 (0.227)		0.000	1.029 (0.229)		0.000	0.468 (0.225)		0.038	0.985 (0.275)		0.000
Model value	$F(5, 822) = 6.087$, $p = 0.000$, $R^2 = 0.036$, $R^2_{Adjusted} = 0.030$)			$F(8, 819) = 22.749$, $p = 0.000$, $R^2 = 0.182$, $R^2_{Adjusted} = 0.174$)			$F(10, 817) = 59.244$, $p = 0.000$, $R^2 = 0.42$, $R^2_{Adjusted} = 0.413$)			$F(14, 813) = 55.954$, $p = 0.000$, $R^2 = 0.491$, $R^2_{Adjusted} = 0.482$)			$F(17, 810) = 47.174$, $p = 0.000$, $R^2 = 0.498$, $R^2_{Adjusted} = 0.487$)		
Variation (ΔR^2; p-value)	0.036; 0.000			0.146; 0.000			0.239; 0.000			0.070; 0.000			0.007; 0.012		

statistics (Feldman and Sol Hart 2018), may evoke feelings of hopelessness in individuals which can, in turn, undermine engagement with climate change mitigation (Maartensson and Loi 2022).

To conclude, our results show that experiencing positive emotions related to sustainable development, having a sense of connection to it (emotional engagement), and having perceptions that significant others are doing something to counteract climate change (descriptive norms) are the most influential variables in the determination of perceived risk.

5. Implications and future research

The present study has important implications for public risk communication. First, as perceptions of the risks posed by climate change are influenced by cognitive, experiential, socio-cultural, and emotional factors, climate change risk messages could be more effective by leveraging all these factors. In particular, communications that aim to heighten the perception that climate change poses a serious risk should prioritize triggering emotional reactions related to the prospect of climate change risk, since emotional engagement was the most influential factor in contributing to risk perception. Moreover, messages should highlight the fact that significant others who are geographically close are doing something to address the issue. Furthermore, mutual respect and socio-altruistic values are factors to be leveraged. Finally, social campaigns should provide cognitive and informational content about the impacts of climate change and may focus less on increasing knowledge about the causes of climate or the responses required to address it, as the latter two factors do not seem related to increased climate change risk perception in the Italian context. However, our study also showed that lack of hope in being able to eliminate, or at least mitigate, climate change might lead people to deny the problem, thus inhibiting pro-environmental actions. Therefore, communication campaigns regarding climate change should also highlight the possibility for people to act in order to counteract its consequences. In conclusion, these factors are important to take into account in public risk communications, as they contribute to determining perceived risk of climate change, which is an important predictor of willingness to act in ways that mitigate it or involve adapting to it.

Lastly, this study is not without limitations. This study was carried out in Italy, and thus it is not possible to generalize the results outside the national context. Furthermore, although the study uses a validated model related to climate change risk perception and integrates it with some psychological variables, it cannot be considered an exhaustive examination of relevant variables. Other studies that take into account variables such as trust in scientists or climate change experts and exposure to climate change campaigns or advertisements are strongly encouraged. Furthermore, this study focuses on the variables that impact perception of the risks posed by climate change but does not explore the link between risk perception and pro-environmental behaviors. However, in many studies, perceived risk is treated as a proxy for behavior (Alcock et al. 2017; Feola et al. 2015), but there are other studies that identify how some moderators can impact this relationship (Shah, Wei, and Ghani 2021; Yu and Yu 2017). Further research is necessary for deepening understanding of public perceptions of the issue of climate change. Moreover, future research might examine climate change events separately in order to determine whether there are potential differences in the perception of the risk posed by climate change, depending on the particular event. Future studies could investigate the relationship between risk perception, hope, and specific emotions elicited by climate change in order to understand the potential effect on climate change risk perception itself.

6. Conclusion

This study showed that Italians' perception of climate change risk is influenced by their engagement with sustainable development and their sense of connectedness to it; by their perception

that important referents are acting to help address climate change (descriptive norms); by values of mutual respect; and by their knowledge of climate change impacts and their direct experience with climate change. Moreover, the addition of Hope to the original model improved prediction of climate change risk perception, and adoption of adaptation and mitigation behaviors. In particular, the perception of hopelessness leads to the implementation of risk denial coping strategies that, by decreasing the perception of risk, might inhibit the adoption of virtuous sustainable behaviors. These results suggest that climate change risk perceptions are complex and multidimensional and that risk communication campaigns should take an integrative approach by stimulating affective and experiential processing mechanisms.

Authors' contributions

Greta Castellini: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing; **Cinzia Castiglioni**: Conceptualization, Investigation, Writing – review & editing, Supervision; **Serena Barello**: Conceptualization, Investigation, Writing – review & editing, Supervision; **Marta Acampora**: Conceptualization, Investigation, Writing – original draft, Writing – review & editing; **Harriet Pinel:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing; **Luigi Lucini:** Project administration, Funding acquisition.

Disclosure statement

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

Ethical statement

This study has been performed in accordance with the Declaration of Helsinki and Ethical approval for the involvement of human subjects in this study was granted by Università Cattolica del Sacro Cuore Research Ethics Committee (CERPS), Reference number 58-22, 16/06/2022.

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Data availability statement

Data are fully available upon request to the corresponding author

References

Af WÅhlberg, Anders E. 2001. "The Theoretical Features of Some Current Approaches to Risk Perception." *Journal of Risk Research* 4 (3): 237–250. https://doi.org/10.1080/13669870152023791.

Alcock, Ian., Mathew P. White, Tim Taylor, Deborah F. Coldwell, Matthew O. Gribble, Karl L. Evans, Adam Corner, Sotiris Vardoulakis, and Lora E. Fleming. 2017. "'Green' on the Ground but Not in the Air: Pro-Environmental Attitudes Are Related to Household Behaviours but Not Discretionary Air Travel." *Global Environmental Change: Human and Policy Dimensions* 42 (January): 136–147. https://doi.org/10.1016/j.gloenvcha.2016.11.005.

Antronico, Loredana, Roberto Coscarelli, Francesco De Pascale, and Dante Di Matteo. 2020. "Climate Change and Social Perception: A Case Study in Southern Italy." *Sustainability* 12 (17): 6985. https://doi.org/10.3390/su12176985.

Biassoni, Federica, Alice Salducco, and Daniela Abati. 2022. "The COVID-19 "First Lockdown" Experience in Italy: The Role of Hope and Optimism and Their Impact on Psychological Well-Being and Risk Perception." *European Journal of Mental Health* 17 (2): 89–103. https://doi.org/10.5708/EJMH.17.2022.2.10.

Bo, Matteo, Luca Mercalli, Federica Pognant, Daniele Cat Berro, and Marina Clerico. 2020. "Daniele Cat Berro, and Marina Clerico. 2020. "Urban Air Pollution, Climate Change and Wildfires: The Case Study of an Extended Forest Fire Episode in Northern Italy Favoured by Drought and Warm Weather Conditions." *Energy Reports* 6 (February): 781–786. https://doi.org/10.1016/j.egyr.2019.11.002.

Bord, Richard J., Robert E. O'Connor, and Ann Fisher. 2000. "In What Sense Does the Public Need to Understand Global Climate Change?" *Public Understanding of Science* 9 (3): 205–218. https://doi.org/10.1088/0963-6625/9/3/301.

Bozzola, Martina, Emanuele Massetti, Robert Mendelsohn, and Fabian Capitanio. 2018. "A Ricardian Analysis of the Impact of Climate Change on Italian Agriculture." *European Review of Agricultural Economics* 45 (1): 57–79. https://doi.org/10.1093/erae/jbx023.

Bradley, Graham L., Zakaria Babutsidze, Andreas Chai, and Joseph P. Reser. 2020. "The Role of Climate Change Risk Perception, Response Efficacy, and Psychological Adaptation in pro-Environmental Behavior: A Two Nation Study." *Journal of Environmental Psychology* 68 (April): 101410. https://doi.org/10.1016/j.jenvp.2020.101410.

Cao, Wenjun, Ziwei Fang, Guoqiang Hou, Mei Han, Xinrong Xu, Jiaxin Dong, Jianzhong Zheng, et al. 2020. "The Psychological Impact of the COVID-19 Epidemic on College Students in China." *Psychiatry Research* 287: 112934. https://doi.org/10.1016/j.psychres.2020.112934.

Castiglioni, Cinzia, Edoardo Lozza, and Andrea Bonanomi. 2019. "The Common Good Provision Scale (CGP): A Tool for Assessing People's Orientation towards Economic and Social Sustainability." *Sustainability* 11 (2): 370. https://doi.org/10.3390/su11020370.

Ciabatta, L., S. Camici, L. Brocca, F. Ponziani, M. Stelluti, N. Berni, and T. Moramarco. 2016. "Assessing the Impact of Climate-Change Scenarios on Landslide Occurrence in Umbria Region, Italy." *Journal of Hydrology* 541 (October): 285–295. https://doi.org/10.1016/j.jhydrol.2016.02.007.

Ciervo, F., G. Rianna, P. Mercogliano, and M. N. Papa. 2017. "Effects of Climate Change on Shallow Landslides in a Small Coastal Catchment in Southern Italy." *Landslides* 14 (3): 1043–1055. https://doi.org/10.1007/s10346-016-0743-1.

Çıplak, Ersun. 2022. "The Mediating Role of the Future Time Perspective in the Relationship between Global Climate Change Awareness and Hope for the Prevention of Climate Change." *South African Journal of Psychology* 52 (4): 498–509. https://doi.org/10.1177/00812463221129362.

Clayton, Susan, and Bryan T. Karazsia. 2020. "Development and Validation of a Measure of Climate Change Anxiety." *Journal of Environmental Psychology* 69: 101434. https://doi.org/10.1016/j.jenvp.2020.101434.

Ding, Yadong, and Jing Li. 2023. "Risk Perception of Coronavirus Disease 2019 and Career Adaptability among College Students: The Mediating Effect of Hope and Sense of Mastery." *Frontiers in Psychology* 14: 1210672. https://doi.org/10.3389/fpsyg.2023.1210672.

European Commission. 2021. *Special Eurobarometer 513 : Climate Change*. Brussels, Belgium.

Feldman, Lauren, and P. Sol Hart. 2018. "Is There Any Hope? How Climate Change News Imagery and Text Influence Audience Emotions and Support for Climate Mitigation Policies." *Risk Analysis: An Official Publication of the Society for Risk Analysis* 38 (3): 585–602. https://doi.org/10.1111/risa.12868.

Feola, Giuseppe, Amy M. Lerner, Meha Jain, Marvin Joseph F. Montefrio, and Kimberly A. Nicholas. 2015. "Researching Farmer Behaviour in Climate Change Adaptation and Sustainable Agriculture: Lessons Learned from Five Case Studies." *Journal of Rural Studies* 39 (June): 74–84. https://doi.org/10.1016/j.jrurstud.2015.03.009.

Fielding, Kelly S., and Brian W. Head. 2012. "Determinants of Young Australians' Environmental Actions: The Role of Responsibility Attributions, Locus of Control, Knowledge and Attitudes." *Environmental Education Research* 18 (2): 171–186. https://doi.org/10.1080/13504622.2011.592936.

Forestieri, Angelo, Elisa Arnone, Stephen Blenkinsop, Angela Candela, Hayley Fowler, and Leonardo V. Noto. 2018. "The Impact of Climate Change on Extreme Precipitation in Sicily, Italy." *Hydrological Processes* 32 (3): 332–348. https://doi.org/10.1002/hyp.11421.

Frondel, Manuel, Michael Simora, and Stephan Sommer. 2017. "Risk Perception of Climate Change: Empirical Evidence for Germany." *Ecological Economics* 137 (July): 173–183. https://doi.org/10.1016/j.ecolecon.2017.02.019.

Ghvanidze, Sophie, Natalia Velikova, Tim H. Dodd, and Wilna Oldewage-Theron. 2016. "Consumers' Environmental and Ethical Consciousness and the Use of the Related Food Products Information: The Role of Perceived Consumer Effectiveness." *Appetite* 107: 311–322. https://doi.org/10.1016/j.appet.2016.08.097.

Gilbert, Christine, and Kenneth Lachlan. 2023. "The Climate Change Risk Perception Model in the United States: A Replication Study." *Journal of Environmental Psychology* 86: 101969. https://doi.org/10.1016/j.jenvp.2023.101969.

Groot, Judith I. M. De, and Linda Steg. 2007. "Value Orientations and Environmental Beliefs in Five Countries." *Journal of Cross-Cultural Psychology* 38 (3): 318–332. https://doi.org/10.1177/0022022107300278.

Heath, Yuko, and Robert Gifford. 2006. "Free-Market Ideology and Environmental Degradation: The Case of Belief in Global Climate Change." *Environment and Behavior* 38 (1): 48–71. https://doi.org/10.1177/0013916505277998.

Hornsey, Matthew J., and Kelly S. Fielding. 2016. "A Cautionary Note about Messages of Hope: Focusing on Progress in Reducing Carbon Emissions Weakens Mitigation Motivation." *Global Environmental Change* 39 (July): 26–34. https://doi.org/10.1016/j.gloenvcha.2016.04.003.

Hundleby, John D., and Jum Nunnally. 1968. "Psychometric Theory." *American Educational Research Journal* 5 (3): 431. https://doi.org/10.2307/1161962.

ISTAT. n.d. "Italian National Institute of Statistics." Accessed January 1, 2023. www.istat.it.

Köberl, Judith, Franz Prettenthaler, and David Neil Bird. 2016. "Modelling Climate Change Impacts on Tourism Demand: A Comparative Study from Sardinia (Italy) and Cap Bon (Tunisia)." *The Science of the Total Environment* 543 (Pt B): 1039–1053. https://doi.org/10.1016/j.scitotenv.2015.03.099.

Leiserowitz, Anthony. 2006. "Climate Change Risk Perception and Policy Preferences: The Role of Affect, Imagery, and Values." *Climatic Change* 77 (1–2): 45–72. https://doi.org/10.1007/s10584-006-9059-9.

Leiserowitz, Anthony, Nicholas Smith, and J. R. Marlon. 2010. *Americans' Knowledge of Climate Change. Yale Project on Climate Change Communication*. New Haven: CT: YPCCC, Yale University.

Lerner, Jennifer S., and Dacher Keltner. 2001. "Fear, Anger, and Risk." *Journal of Personality and Social Psychology* 81 (1): 146–159. https://doi.org/10.1037/0022-3514.81.1.146.

Li, Christine, and Martha C. Monroe. 2018. "Development and Validation of the Climate Change Hope Scale for High School Students." *Environment and Behavior* 50 (4): 454–479. https://doi.org/10.1177/0013916517708325.

Luthans, Fred, Steven M. Norman, Bruce J. Avolio, and James B. Avey. 2008. "The Mediating Role of Psychological Capital in the Supportive Organizational Climate—Employee Performance Relationship." *Journal of Organizational Behavior* 29 (2): 219–238. https://doi.org/10.1002/job.507.

Maartensson, Hanna, and Natasha M. Loi. 2022. "Exploring the Relationships between Risk Perception, Behavioural Willingness, and Constructive Hope in pro-Environmental Behaviour." *Environmental Education Research* 28 (4): 600–613. https://doi.org/10.1080/13504622.2021.2015295.

MacInnis, Deborah J., and Gustavo E. De Mello. 2005. "The Concept of Hope and its Relevance to Product Evaluation and Choice." *Journal of Marketing* 69 (1): 1–14. https://doi.org/10.1509/jmkg.69.1.1.55513.

Moreira, Paulo A. S., Sofia Ramalho, and Richard A. Inman. 2021. "The Engagement/Disengagement in Sustainable Development Inventory (EDiSDI)." *European Journal of Psychological Assessment* 37 (5): 344–356. https://doi.org/10.1027/1015-5759/a000619.

Morgan, M. Granger. 2002. *Risk Communication: A Mental Models Approach*. Cambridge, UK: Cambridge University Press.

Moser, Susanne C. 2016. "Reflections on Climate Change Communication Research and Practice in the Second Decade of the 21st Century: What More is There to Say?" *Wiley Interdisciplinary Reviews: Climate Change* 7 (3): 345–369.

Nanni, Paola, David J. Peres, Rosaria E. Musumeci, and Antonino Cancelliere. 2021. "Worry about Climate Change and Urban Flooding Risk Preparedness in Southern Italy: A Survey in the Simeto River Valley (Sicily, Italy)." *Resources* 10 (3): 25. https://doi.org/10.3390/resources10030025.

Newman, Alexander, Deniz Ucbasaran, Fei Zhu, and Giles Hirst. 2014. "Psychological Capital: A Review and Synthesis." *Journal of Organizational Behavior* 35 (S1): S120–S138. https://doi.org/10.1002/job.1916.

Ojala, Maria. 2012. "Hope and Climate Change: The Importance of Hope for Environmental Engagement among Young People." *Environmental Education Research* 18 (5): 625–642. https://doi.org/10.1080/13504622.2011.637157.

Ostrom, Lee, and Cheryl Wilhelmsen. 2019. *Risk Assessment. Risk Assessment: Tools, Techniques, and Their Applications*. Hoboken, NJ: Wiley. https://doi.org/10.1002/9781119483342.

Pede, Elena Camilla, Giuliana Barbato, Alessandra Buffa, Marta Ellena, Paola Mercogliano, Guglielmo Ricciardi, and Luca Staricco. 2022. "Mountain Tourism Facing Climate Change. Assessing Risks and Opportunities in the Italian Alps." *TeMA – Journal of Land Use, Mobility and Environment* 15 (1): 25–47.

Peters, Ellen, and Paul Slovic. 2007. "Affective Asynchrony and the Measurement of the Affective Attitude Component." *Cognition & Emotion* 21 (2): 300–329. https://doi.org/10.1080/02699930600911440.

Pongiglione, Francesca. "Climate Change and Individual Decision Making: An Examination of Knowledge, Risk Perception, Self-Interest and Their Interplay." November 16, 2011. FEEM Working Paper No. 72.2011. Available at *SSRN:* https://ssrn.com/abstract=1960496 or http://dx.doi.org/10.2139/ssrn.1960496.

Reser, Joseph P, et al. 2012. *Public Risk Perceptions, Understandings and Responses to Climate Change and Natural Disasters in Australia, 2010 and 2011*. Gold Coast: National Climate Change Adaptation Research Facility.

Schwartz, Shalom H. 1992. "Universals in the Content and Structure of Values: Theoretical Advances and Empirical Tests in 20 Countries." *Advances in Experimental Social Psychology*. 25: 1–65. https://doi.org/10.1016/S0065-2601(08)60281-6.

Searle, Kristina, and Kathryn Gow. 2010. "Do Concerns about Climate Change Lead to Distress?" *International Journal of Climate Change Strategies and Management* 2 (4): 362–379. https://doi.org/10.1108/17568691011089891.

Shah, Zakir, Lu Wei, and Usman Ghani. 2021. "The Use of Social Networking Sites and Pro-Environmental Behaviors: A Mediation and Moderation Model." *International Journal of Environmental Research and Public Health* 18 (4): 1805. https://doi.org/10.3390/ijerph18041805.

Slovic, Paul. 1992. "Perception of Risk: Reflections on the Psychometric Paradigm."

Snyder, C. R. 1995. "The Psychology of Hope: You Can Get There from Here." *Choice Reviews Online* 32 (10): 32–5941–32-5941. https://doi.org/10.5860/CHOICE.32-5941.

Soucy, Alyssa, Sandra De Urioste-Stone, Parinaz Rahimzadeh-Bajgiran, and Aaron Weiskittel. 2022. "Drivers of Climate Change Risk Perceptions among Diverse Forest Stakeholders in Maine, USA." *Society & Natural Resources* 35 (5): 467–486. https://doi.org/10.1080/08941920.2021.1991066.

Spence, A., W. Poortinga, C. Butler, and N. F. Pidgeon. 2011. "Perceptions of Climate Change and Willingness to Save Energy Related to Flood Experience." *Nature Climate Change* 1 (1): 46–49. https://doi.org/10.1038/nclimate1059.

Stern, P. C., Dietz, T. Abel, G. A. Guagnano, and L. Kalof. 1999. "A Value-Belief-Norm Theory of Support for Social Movements: The Case of Environmentalism." *Human Ecology Review* 6 (8): 1–97.

Stevenson, Kathryn, and Nils Peterson. 2015. "Motivating Action through Fostering Climate Change Hope and Concern and Avoiding Despair among Adolescents." *Sustainability* 8 (1): 6. https://doi.org/10.3390/su8010006.

Tobler, Christina, Vivianne H. M. Visschers, and Michael Siegrist. 2012. "Addressing Climate Change: Determinants of Consumers' Willingness to Act and to Support Policy Measures." *Journal of Environmental Psychology* 32 (3): 197–207. https://doi.org/10.1016/j.jenvp.2012.02.001.

Torma, Gabriele. 2020. "How to Cope with Perceived Tension towards Sustainable Consumption? Exploring Pro-Environmental Behavior Experts' Coping Strategies." *Sustainability* 12 (21): 8782. https://doi.org/10.3390/su12218782.

Van Der Linden, Sander. 2015. "The Social-Psychological Determinants of Climate Change Risk Perceptions: Towards a Comprehensive Model." *Journal of Environmental Psychology* 41 (March): 112–124. https://doi.org/10.1016/j.jenvp.2014.11.012.

Van der Linden, Sander. 2016. "A Conceptual Critique of the Cultural Cognition Thesis." *Science Communication* 38 (1): 128–138. https://doi.org/10.1177/1075547015614970.

Van der Linden, Sander. 2017. "Determinants and Measurement of Climate Change Risk Perception, Worry, and Concern." *The Oxford Encyclopedia of Climate Change Communication*. Oxford, UK: Oxford University Press.

Van Eck, Christel W., Bob C. Mulder, and Sander van der Linden. 2020. "Climate Change Risk Perceptions of Audiences in the Climate Change Blogosphere." *Sustainability* 12 (19): 7990. https://doi.org/10.3390/su12197990.

Van Passel, Steven, Emanuele Massetti, and Robert Mendelsohn. 2017. "A Ricardian Analysis of the Impact of Climate Change on European Agriculture." *Environmental and Resource Economics* 67 (4): 725–760. https://doi.org/10.1007/s10640-016-0001-y.

Vermeir, Iris, and Wim Verbeke. 2006. "Sustainable Food Consumption: Exploring the Consumer 'Attitude – Behavioral Intention' Gap." *Journal of Agricultural and Environmental Ethics* 19 (2): 169–194. https://doi.org/10.1007/s10806-005-5485-3.

Wachinger, Gisela, et al. 2010. "Risk Perception and Natural Hazards." *CapHaz-Net WP3 Report*.

Wang, Jianming, Ninh Nguyen, and Xiangzhi Bu. 2020. "Exploring the Roles of Green Food Consumption and Social Trust in the Relationship between Perceived Consumer Effectiveness and Psychological Wellbeing." *International Journal of Environmental Research and Public Health* 17 (13): 4676. https://doi.org/10.3390/ijerph17134676.

Wong-Parodi, Gabrielle, and Nina Berlin Rubin. 2022. "Exploring How Climate Change Subjective Attribution, Personal Experience with Extremes, Concern, and Subjective Knowledge Relate to pro-Environmental Attitudes and Behavioral Intentions in the United States." *Journal of Environmental Psychology* 79 (February): 101728. https://doi.org/10.1016/j.jenvp.2021.101728.

Xie, Belinda, Marilynn B. Brewer, Brett K. Hayes, Rachel I. McDonald, and Ben R. Newell. 2019. "Predicting Climate Change Risk Perception and Willingness to Act." *Journal of Environmental Psychology* 65 (October): 101331. https://doi.org/10.1016/j.jenvp.2019.101331.

Yu, Tai-Yi, and Tai-Kuei Yu. 2017. "The Moderating Effects of Students' Personality Traits on Pro-Environmental Behavioral Intentions in Response to Climate Change." *International Journal of Environmental Research and Public Health* 14 (12): 1472. https://doi.org/10.3390/ijerph14121472.

Zhuang, Jianfeng, Yali Jiang, and Haiping Chen. 2021. "Stress and Career Adaptability during COVID-19: A Serial Multiple Mediation Model." *Social Behavior and Personality: An International Journal* 49 (8): 1–11. https://doi.org/10.2224/sbp.10551.