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HEXACO Traits, Emotions, and Social Media in Shaping Climate Action and Sustainable Consumption: The Mediating Role of Climate Change Worry

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Abstract: Climate change is an irreversible crisis that urgently calls for social transformation to protect human livelihood and environmental stability. Establishing awareness, building environmental literacy, and citizens' mobilization are the steps toward sustainable change in giving a legacy of hope to future generations. This research explores major psychological and social drivers of pro-environmental behavior, considering the influence of HEXACO personality traits, climate anxiety (CCW), and social media engagement (SMI) on sustainable consumption (SC) and climate action intentions (CCI). Our findings revealed th eco-guilt (EGQ) and environmental empathy (EE) are immediate drivers for climate action, while long-term nurturance of eco-grief (ECOG) leads to engagement, supporting the notion that different emotions uniquely contribute to pro-environmental intentions. In terms of personality predictors, HEXACO's traits of emotionality (E), honesty-humility (HH), and openness (O) are revealed to be significant, with emotionality also moderating the relationship between eco-grief and climate change action. The results reveal that connectedness to nature (CTN) and moderate levels of climate anxiety synergistically promote sustainable consumption intentions, while demographic factors such as gender, education levels, and exposure to social media moderate these intentions. Females also show a higher level of climate action intention in response to eco-guilt and eco-grief, while individuals with higher levels of education are more responsive to climate-related social media content, increasing their sustainable consumption behaviors. In exploring such interactions, this study aims to add to the understanding of what drives people toward valued environmental behaviors and, in turn, to inform effective climate advocacy, education, and personality-driven strategies to promote environmental engagement.

Keywords: climate change intentions; sustainable consumption; climate change worry; emotional predictors; pro-environmental behavior; HEXACO; social media information; generalized linear models (GLMs); mediation analysis

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1. Introduction

The term 'climate change' refers to the change in the average weather conditions of a particular region. In recent years, this term has been commonly used to denote the recently observed changes in weather conditions at the planetary level, which, as evidence suggests, is due to anthropogenic factors [1–3]. Although climate change is considered the most challenging issue that human social, political, and economic systems have ever faced, the social sciences have limited scientific discourse on the matter due to scientific constitutions, where the social is separated from the natural [4–7]. Since the 1960s, environmental degradation has been highlighted as a major problem, which was at that time connected to a relatively radical proposition: that society should behave with intergenerational care to protect the interests of the future [8–11]. While social sciences have played a minor role in the matter to date, there is now a growing awareness of the fact that climate change is strongly related to human choices as far as development and lifestyle

decisions are concerned [5–7]. The Global Climate Observing System (GCOS) also identifies a set of key global climate indicators beyond those of temperature [1,2,5]. More broadly, these comprehensively include climate data ranges from land and ocean temperatures, atmospheric carbon dioxide, ocean acidification, and sea levels to a cryosphere extent [1,2,5]. This kind of consistent temporal analysis of weather data provides us with the ability to give estimates on long-term conditions of climate and understand more about regional climate patterns. Figure 1 illustrates both the current and historical contributions of greenhouse gas emissions across global regions, revealing significant disparities where certain regions contribute disproportionately to emissions relative to their population sizes. This context emphasizes the importance of studying factors that motivate climate action and sustainable behaviors [12].

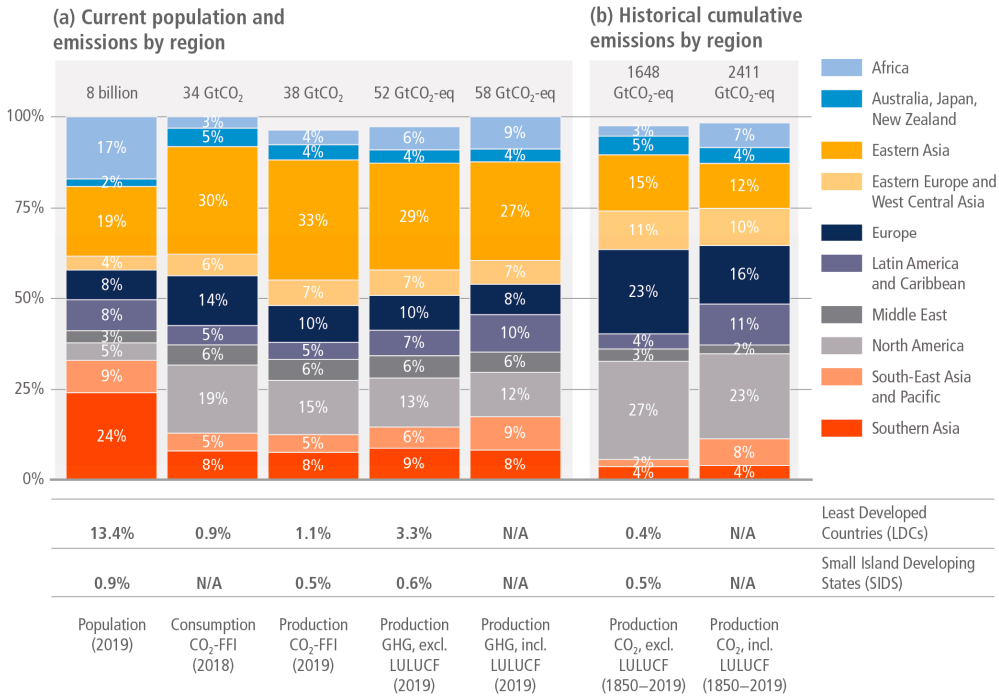

Figure 1. (**a**) Current population distribution and greenhouse gas emissions by region as of 2019, highlighting the contributions from various regions relative to their population sizes. (**b**) Historical cumulative greenhouse gas emissions by region from 1850 to 2019, showing the long-term impact of different regions on global emissions levels. Data includes production-based emissions, both excluding and including land use, land-use change, and forestry (LULUCF). Source [12].

Global warming is one of the effects of climatic change, which, although gradual, is considered rapid by geological standards [13–15]. Severe and frequent meteorological events in the form of hurricanes and storms are foreseen because of the energy building up in the troposphere as a result of radiation trapping. Sea-level rise is believed to be a sure consequence, mainly due to the thermal expansion of water, whereas alpine glaciers melting will contribute less [13–15]. The most flourishing impact of climate change can be expected in coastal areas, which houses a third of the world's population, in forms such as flooding, erosion, salinization of aquifers, and wetland degradation. Impoverished countries are finding it harder to implement protection mechanisms that are direly needed [11,16,17]. Negative consequences for agriculture continue to be expected, as climate change may exacerbate desertification and reinforce problems of water scarcity, apart from the alleged positive effect of increased carbon dioxide. Other impacts include disruption of ecosystems, degradation of living conditions, increased energy consumption for air conditioning, and malfunctioning of technical works. However, in reality, the main drivers and solutions to climate change lie in the realm of the social sciences [5–7].

The issue of climate change has received considerable scrutiny, not only for its effects on the environment, but also on people's emotional and mental well-being [18–21]. The climate that prevails in a particular geographical location, as well as the climatic changes that occur in that location, impact the human element to a great and intense extent [22–24]. More specifically, climate change is linked to mental health, creating effects ranging from anxiety to as far as suicidal thoughts and intentions. Both mental illness and environmental degradation are universal challenges, and there is a growing wealth of research literature on the links between the pair [25–28]. Furthermore, people value biodiversity differently, either for intrinsic reasons or for the services that ecosystems provide. Individuals who live intimately in connection with their environment, or individuals with high environmental empathy and perceptions, consider the habitat to constitute a strong part of their identity, and anthropogenic changes to this environment can lead to distress and feelings of loss [8,29–31].

While there is a growing body of research into the psychological determinants of pro-environmental behavior, much of this work to date has been limited to the Big Five personality model, whilst the influence of the HEXACO model in the climate change context remains underexplored [32–34]. While the predictors of eco-guilt, eco-grief, and environmental empathy have partly been brought into awareness, very few have combined these factors with nature-related measures of climate change anxiety, nature connectedness, and environmental awareness (EA) [26,35,36]. Fragmented research has resulted in the inability to understand fully the combined impacts of these variables on climate action and sustainable consumption [37–39]. In addition, though selected research looks into climate change behavior, few studies have taken into account the moderating role of social media use or how direct experiences of climate change may interact with these psychological factors [40–42]. Moreover, there is limited research into demographic variables such as age and gender in analyzing these associations, since the studies are mostly general or homogeneous [35,43]. This underlines the incorporation of these variables in an integrated approach that should provide a clear understanding of their combined interactions in climate-related behaviors across different demographic groups.

This study combines emotional, environmental, and personality predictors to present a multilevel model of the behavior relevant to climate change. With the inclusion of the HEXACO model of personality, this research extends the existing literature beyond the Big Five toward traits such as honesty-humility and emotionality, which may uniquely influence pro-environmental engagement. Experiences of climate change influence behavior through mediators of climate action, coupled with nature connectedness, and social media as a moderator. Including demographic variables and personality traits provides nuanced insights into behavioral patterns. Last but not least, with the application of Generalized Linear Models (GLMs), this study will be able to illustrate in detail the influences of different HEXACO traits on climate action and sustainable consumption.

The results highlight both emotional and personality factors as decisive in predicting climate-related behavior and show that eco-guilt, eco-grief, and environmental empathy are all positively related to climate action intentions. In the HEXACO model, emotionality and honesty-humility emerge as strong drivers of pro-environmental action, while honesty-humility and openness to experience provide moderate support to sustainable consumption. Mediation analysis showed, in particular, that personal experience with climate change predicts intentions to take climate action partially through climate change worry and eco-guilt, while personal experience with climate change predicts sustainable consumption partially via eco-guilt. Furthermore, demographic variables of age and gender, in conjunction with social media influence, serve as moderators in the above relationships, indicating their effectiveness in climate advocacy. This conceptualization of emotional, personality, and demographic predictors explains articulately the complicated interaction that fuels diverse pro-environmental behaviors.

The article is structured as follows: Section 2 presents an overview of the relevant research on the factors that influence climate anxiety, and psychological and behavioral

influences on climate change. We focus our interest on how eco-emotions, behavioral motivations, and personality traits affect climate actions and sustainable consumption. Section 3 contains a detailed description of the model we developed and tested for our research purposes, followed by a data analysis in Section 4. Section 5 examines and interprets the main findings and indicates relevant limitations. Finally, Sections 6 and 7 conclude the article and make recommendations for policymakers, managers, and further research.

2. Literature Review

2.1. Climate Anxiety, Psychological and Behavioral Influences to Climate Change

Interpersonal differences create variability in the mental health response to climate change. Generally, people of lower socio-economic status bear the most severe impacts [1,22,44,45]. Extreme weather events and environmental degradation, such as damage from storms or loss of natural settings, are contributing directly to psychological distress in the forms of depression, PTSD, and chronic grief among vulnerable populations [46–49]. These effects are worsened by long-term climate changes that displace people and possibly lead to conflicts, further worsening the conditions of their mental health. Beattie and McGuire [20] and Council et al. [50] present some of the mechanisms being investigated for these associations, including physiological stressors such as heat and pollution, and social and cognitive processes that affect mental health. Common barriers of addressing climate impacts include resource limitations, lack of information, leadership challenges, and competing priorities that underline the complexity of climate adaptation [44,48,51].

The recent literature on climate change has underlined the psychological and emotional dimensions of the perception of its impacts in ways that include, among others, the prevalence of climate anxiety and climate change worry in both youth and adults. Several scales for the measurement of these responses have been developed, underlining a complex multidimensional phenomenon. Clayton and Karazsia [18] presented the Climate Change Anxiety Scale (CCAS) and identified both cognitive–emotional and functional impairments, while Simon, Pakingan, and Aruta [45] investigated its mediating role in Filipino adolescents' mitigation behaviors, showing significant results. Larionow et al. [52] reported on the validation of the Polish version of the Climate Anxiety Scale (CAS), finding links between anxiety and personal experiences, along with behavioral engagement, but not with general anxiety symptoms. Plohl et al. [53] extended this work to validate Slovenian versions of the CAS and CCWS, and these instruments turned out to be reliable in explaining perceived threats and support for climate policies.

Stewart [54] developed the CCWS, focusing on proximal worry rather than global impacts, and demonstrated that it possesses internal consistency and temporal stability. Reese, Rueff, and Wullenkord [27] looked into which factors could be antecedents for climate anxiety and focused on risk perception and political orientation. The findings suggested that persons who perceive a higher level of risk and are left-leaning in their political orientation are more likely to develop climate anxiety. On the other hand, self-efficacy and nature-connectedness did not relate. These are further complemented by the work conducted by Mayer, Frantz, Bruehlman-Senecal, and Dolliver [44] on psychological benefits produced by exposure to nature, which demonstrated that exposure to nature increased connectedness to nature, positive affect, and the ability to reflect on life issues, where such effects were more pronounced for actual nature exposure compared to virtual. Despite these divergent approaches, a common thread in research has been that climate anxiety and concern are derived from personal experience of the impact of climate change and emotional reactions, especially within the younger segment of the population [18,27,44,45,52–54]. However, local differences occur in how such emotional reactions get translated into behavior. While this offers promising interventions for climate anxiety, it raises questions about accessibility and scalability, particularly for urban or resource-limited populations.

Critically, while many studies highlight climate anxiety's role in behavioral intentions, evidence remains inconsistent. Whereas Simon, Pakingan, and Aruta [45] and Larionow,

Sołtys, Izdebski, Mudło-Głagolska, Golonka, Demski, and Rosińska [52] have reported some mediating effects, other studies [18,27,53,54] have reported partial behavioral results despite high anxiety levels. On the contrary, the research carried out by Leka and Furnham [55] on skepticism and that of Reese, Rueff, and Wullenkord [27] on political orientation show the influence that individual factors have in responding to information regarding climate change. The restorative effect that nature has on individuals, probably as a way of alleviating climate anxiety, is brought forth in the research by Mayer, Frantz, Bruehlman-Senecal, and Dolliver [44]. Overall, while there are emerging studies that outline the complexity of emotional and behavioral responses to climate change, there is also a residual presence of large gaps. Most studies are considerably limited by reliance on self-report measures, which, as has been mentioned, reduces generalizability across diverse populations. Interventions like exposure to nature show promise, yet need further testing to establish their applicability across different cultures and effectiveness in the long run. Engagement with these limitations and the integration of individual, cultural, and systemic factors will be necessary in the furtherance of both a theoretical understanding and practical strategies to facilitate sustainable behaviors and psychological resilience.

2.2. Eco-Emotions and Behavioral Motivation in Climate Action

Current research on the emotional dimensions of climate change has examined eco-guilt, eco-anxiety, ecological grief, and more, for their function in motivating pro-environmental behavior (PEB) [21,36,42,56–58]. While such studies present clear results regarding the motivational function of emotions, nuanced differences also show the multi-faceted nature of emotional responses and what these mean for climate action. Bahja and Hancer [56] noticed that environmentally-friendly tourism behavior (EFTB) is positively influenced by eco-guilt. It was also observed that a great part of the variance in behavior was explained by environmental knowledge and concern. On the other hand, eco-guilt as a factor did not directly affect revisiting intentions of tourists; however, through EFTB, it had a positive indirect effect. The same role of emotional feeling was observed by Marczak, Wierzba, Zaremba, Kulesza, Szczypiński, Kossowski, Budziszewska, Michałowski, Klöckner, and Marchewka [26], who in 2023 presented the ICE-inventory of climate emotions, thus identifying an array of emotional feelings: from anger, through guilt, to anxiety. The findings here are in line with those by Bahja and Hancer [56] in pointing out the motivational function of eco-emotions. Ágoston, Urban, Nagy, Csaba, Kőváry, Kovacs, Varga, Dull, Monus, and Shaw [21] introduced validated measures for eco-guilt, ecological grief, and eco-anxiety, showing that these are positively associated with PEB, therefore aligning with [26,56]. While these studies have focused on the adaptive aspects of eco-emotions, they tend to neglect their potential psychological costs, which may be limiting factors for their motivational role. This represents an important gap in knowledge that needs to be filled to ensure that emotionally based climate interventions are designed in ways that stay within the bounds of ethical and psychosocial sustainability.

However, Ágoston, Urban, Nagy, Csaba, Kőváry, Kovacs, Varga, Dull, Monus, and Shaw [21] also pointed out the possible psychological cost these emotions could incur by noting their connection with distress. On extending this, Zeier and Wessa [36] used a German sample to validate measures and confirm they related positively to intentions of climate action and support for policy; however, they also found that eco-emotions correlate positively with higher levels of climate anxiety, general anxiety, and depression, indicative of both their adaptive and maladaptive aspects. Jylhä, Ojala, Odisho, and Riise [43] extended TPB to climate-friendly food choices among youth, including emotional factors like worry about climate change. They found that worry strongly predicted food-choice intentions, supporting the motivational role of negative emotions seen in other studies. These findings point to a dual-edged nature of eco-emotions, whereby their motivational potential needs to be weighed and balanced against the risks of emotional overload or distress undermining sustained engagement. One future research direction might be

toward understanding the thresholds at which eco-emotions transition from adaptive to maladaptive.

However, whereas Bahja and Hancer [56] observed an indirect influence of emotions, Jylhä, Ojala, Odisho, and Riise [43] observed a direct effect of the concern about behavioral intentions. Indeed, this has hinted that the role of worry and similar emotive states is context-dependent. On the other hand, Branham [59] examined nature connectedness in regard to PEB and well-being. The authors found that interoceptive awareness and secure attachment to nature served as strong predictors of nature connection, which, in turn, facilitated pro-environmental behavior and individual well-being. This positive emotional approach also falls in line with other studies on motivation, but perhaps offers a different direction in the realm of engagement through emotional resilience rather than from distress.

In summary, these findings uniformly support the view that negative emotions, such as eco-guilt, anxiety, and grief, facilitate behavior toward environmental protection [21,26,36,43,56]. At the same time, however, while some of these studies accent the psychological cost these emotions may impose (such as [21] and [36]), others suggest that positive emotional experiences, such as nature connectedness [59], can act as protective factors and thus become motivational drivers. This duality of perspective points to a critical tension in the literature: while negative emotions may inspire immediate action, they risk leading to emotional fatigue or distress over time [44,45,52]. Positive emotions, on the other hand, such as nature connectedness, may enable more sustainable and resilient engagement, but lack the urgency for immediate behavioral change. Balancing this is crucial when developing holistic, effective interventions that make use of both emotional pathways.

2.3. Psychological and Situational Drivers of Green Consumption in Climate Change

Ecological awareness has created a strategic market niche for the ecologically responsible consumer, and it has become increasingly important for businesses to minimize harm to the environment while embedding sustainability into business processes [49,56,57,60]. Anthropogenic climate change is undoubtedly a global crisis; however, high-emission countries have shown resistance to reduction policies underlined by how governments and NGOs spearhead citizen activism and behavioral shifts [14,40,41,49]. Such prudent ways to help these communities include incorporating scientific and indigenous knowledge into training that helps communities adapt to climate hazards. Because of this, governments support such initiatives. Educators from the affected regions are key agents in community-led solutions to further the so-wanted hope toward a sustainable tomorrow. Again, Armstrong, Krasny, and Schuldt [48] give hope for a sustainable tomorrow and thus motivate individual-level and societal involvement in environmentally sustainable behavior that would consider the welfare of future generations. While these local-level approaches tend to provide promising effects in localized contexts, most of them fail in scaling up and therefore call for integrative strategies across individual, societal, and global initiatives. This omission only underlines the imperative of alignment of local action at the front lines with more systemic policies if the impact is to be meaningful.

Recent studies on green behavior and consumption have estimated how a variety of psychological, social, and situational factors influence consumers' environmentally friendly choices. Zheng, Zheng, Chen, and Tang [58], probed into the role of awareness of the environment and competitiveness in the consumption of green food. They found that while environmental awareness positively influenced green self-efficacy and perceived control, competitive awareness had a negative effect. Green self-efficacy was stronger in predicting green food purchase intention. On the other hand, García-Salirrosas et al. [61] conducted an analysis with the Theory of Planned Behavior (TPB) about the willingness of Peruvian consumers to pay for green products and collected evidence that environmental awareness directly enhances attitude and perceived behavioral control towards the product, both influencing purchase intention. These findings hint at a more subtle interplay between intrinsic and extrinsic motivators, implying that intrinsic motivations may yield more

viable outcomes in the long term. The general neglect of competitive awareness in other studies suggests, however, that this area requires further exploration to fully understand its role in green consumption.

In recent years, Severo, De Guimarães, and Dellarmelin [16] have examined the trends in sustainable consumption across generations, both in Brazil and Portugal, in relation to the COVID-19 pandemic. From their work, it emerged that the pandemic increased trends of sustainable consumption, where baby boomers and residents of Portugal recorded the most dramatic changes in behavioral traits. This is concurrent with the work of Zheng, Zheng, Chen, and Tang [58], which proved that increased environmental awareness and situation contagion in relation to the pandemic positively influenced green consumption behavior. By contrast, Parmentier et al.'s [62] study of eco-anxiety and pro-environmental behavior interlinkages showed that while eco-worry positively mediated the environmental crisis–pro-environmental behavior relationship, impairment due to climate anxiety did not contribute to the former. This implies that while emotions like eco-worry could promote green consumption, more profound emotional distress would not, providing a supportive approach surrounding how emotions influence consumption in a sustainable manner.

In Liu's [63] study, the focus was on narrative transportation effects among Chinese university students. The authors established that empathy with nature and environmental attitude mediated the effect of narrative transportation on environmental intentions and offered insight into how educational strategies may improve sustainable behavior through emotional and attitudinal engagement. Similarly, Jylhä, Ojala, Odisho, and Riise [43] investigated the impact of worry about climate change and attitudes on food choice intention among young people. Whereas worry was found to be a powerful predictor, ambivalence weakens the attitude and intention relationship, hence highlighting the complexity problem in emotional influences on sustainable behavior. Horani and Dong [64] and Guo and Xiao [60] questioned green consumerism concerning technological perspectives. Horani and Dong [64] focused on sustainable purchasing intention concerning smartphones in the Chinese market and underlined the importance of satisfying conventional and sustainability-related customer needs. Guo and Xiao [60] approached green smart home products, showing the strong impacts of autonomy, environmental agility, and task–technology fit on purchase intentions. Stress alignment in product characteristics with the needs and values of consumers fosters sustainable technology adoption.

Finally, Ye et al. [65] investigated the impact of product scarcity appeals on green product purchase intention and established that perceived greenwashing can mediate the negative impacts of the appeal of scarcity, and such effects are moderated by impression management motives. This would, therefore, support the possible pitfalls of marketing strategies when perceived as manipulative, stressing the need to necessitate authenticity in green marketing. In summary, the present studies shed light on the interplay of psychological, social, and situational drivers of sustainable consumption. At this point, most of the extant research underlines the role of environmental awareness and emotions such as eco-worry in fostering green behavior, and there is an urgent need to investigate how these drivers interact with competitive and technological factors. Most of them have limitations in that they rely on particular cultural or demographic groups, limiting the generalization of findings, and hence call for inclusive studies in developing relevant insights globally.

2.4. Personality Traits and Climate Change Action

According to the common consensus of the majority of researchers in the field of climatology and environmental studies, it has been argued that the climate that prevails in a particular geographical location has a direct relationship of relevance and interdependence with the formed personality traits of the people currently living and working in that location [32–34,66]. Specifically, climate is an important factor that shapes the levels of intelligence, acumen, condescension, way of perceiving situations, and many other endogenous characteristics of individuals [31–34,46,66]. While this claim offers an

intriguing perspective, the evidence supporting such direct links is highly debated, and further rigorous, interdisciplinary studies are necessary to consolidate these claims.

Recent findings on personality determinants of actions related to climate change illustrate how psychological traits, beliefs, and cognitive processes influence one's environmentalistic behavior [23,34,67–69]. Ogunbode et al. [70] examined whether neuroticism and efficacy beliefs moderate the influence of worry about climate change, whereas the results show that worry about climate change impairs mental well-being irrespective of perceived efficacy. Interestingly, high neuroticism conceals this effect rather than amplifying it, which, in turn, suggests that one cannot say that harmful impacts of climate worry result from dispositional traits. It points to the importance of climate-related emotions as specific stressors targeted by interventions. This echoes the more complex relationship between dispositional traits and climate-related emotions, which would indicate that climate worry should not universally relate to personality traits, but be a context-specific stressor.

Rothermich, Johnson, Griffith, and Beingolea [67] used a trait-level approach to demonstrate how openness, perspective-taking, and demographic variables like age and gender predict attitudes about climate change. The authors further established a basis for achieving or encouraging pro-environmental strategies. Similarly, Rothermich, Johnson, Griffith, and Beingolea [67] studied the relationship of climate anxiety with pro-environmental behavior in adolescents. The results showed that while anxiety, in general, nurtured pro-environmental behavior, at high levels, anxiety did not result in 'eco-paralysis', which, in turn, suggested that supporting environmental efficacy could make adolescents more active towards climate action. Gebhardt, Schwaab, Friederich, and Nikendei [22] concentrated their research on the difference in the personal experiences of individuals already suffering from mental health issues, demonstrating their specific vulnerability in depressive, anxious, and traumatic symptoms due to climate change and emphasizing the special need for targeted mental health interventions. Correspondingly, Yu and Yu [47] probed for personality traits concerning pro-environmental behavior among university students and found that traits like environmental concern, perceived risk, and social norms do indeed have an influential role in students' intentions to act, moderated by personality traits. These findings highlight that personality traits combines with external social and environmental factors to determine attitudes and behaviors surrounding climate change; interventions would need to address both individual differences and contextual barriers.

In a two-study analysis, Nezlek and Cypryańska [23] conducted research into the relationship between Big Five traits and CCBs and found that openness, neuroticism, and conscientiousness were positively related to CCBs, with the latter mediated through perceived efficacy of those CCBs. These findings signify again the notion that interventions need to address an individual's perceived effectiveness of their actions if pro-environmental behavior is to be maximized. This focus was expanded by Tucholska, Gulla, and Ziernicka-Wojtaszek [35] in 2024, who explored the cognitive, emotional, and behavioral factors which determine pro-environmental actions, depicting core personality traits and time perspectives in the prediction of beliefs in climate change myths, climate anxiety, and action, indicating the importance of personality in shaping responses toward climate. However, much of this research relies on the Big Five framework, limiting the capacity for capturing morally and emotionally nuanced traits that are available through the HEXACO model.

As recently as 2023, Jessani and Harris [66] discussed how tolerance for ambiguity and political orientation affect climate denial. The authors reported that low ambiguity tolerance and conservative ideologies predict belief in denial of anthropogenic climate change. This is indicative that cognitive and personality traits drive both environmental beliefs and the resistance to change. On the other hand, Zacher and Rudolph [28] confirmed that individuals with better environmental knowledge exhibit lower climate anxiety; hence, education and knowledge play a protective role in dealing with distress attributed to climate change. Hidalgo-Crespo, Velastegui-Montoya, Amaya-Rivas, Soto, and Riel [33] assessed the value-belief-norm theory and pro-environmental behavior as related to different personality traits, such as avoiding waste and green consumption,

both of which proved that personal conscience and subjective norms play important roles. Colombo et al. [71] critically overviewed different models, among them TPB, NAM, and VBN, with a special emphasis on how to bridge the gap between climate knowledge and behavior. The review considers dispositional traits and self-regulation crucial in this respect. Finally, Caddick and Feist [29] emphasized motivated reasoning concerning climate change beliefs. The authors establish cognitive style, personality, and ideology as predictors of the processing of information relevant to anthropogenic climate change. Individuals who support human-caused climate change process information more objectively, but the denial is accompanied by biased reasoning, which would indicate how cognitive and personality differences shape the attitude towards the climate.

These studies, in combination, indicate that personality traits, cognitive styles, and emotional responses have a cardinal role in pro-environmental behavior. Whereas openness and conscientiousness generally facilitate engagement, other traits (for instance, a low tolerance for ambiguity and high neuroticism) may represent barriers to effective action on climate or cause an increase psychological distress. These findings underpin the importance of tailored interventions for individual differences by enhancing self-regulation, fostering environmental efficacy, and using clear and accurate information to promote pro-environmental behavior and psychological well-being.

HEXACO's Influence on Climate Action

The HEXACO personality model allows for certain advantages compared to the Big Five framework when researching pro-environmental behaviors. Although the Big Five has been applied by many studies exploring general personality–behavior links, HEXACO proposes one important sixth dimension: honesty-humility, defined by sincerity, fairness, and the avoidance of greed. This dimension is particularly relevant to climate action and sustainable consumption, where moral and ethical considerations often play a decisive role. The inclusion of honesty-humility in HEXACO allows for a more in-depth exploration of behaviors rooted in moral responsibility, a feature often overlooked in traditional models like the Big Five. Indeed, honesty-humility has emerged as one of the most consistent predictors of pro-environmental behaviors, thus enabling further understanding of actions motivated by ethical responsibility. Moreover, emotional sub-facets of emotionality represent anxiety and sentimentality in their detailing to explain the motivational drivers of climate engagement. Works such as Pickering and Dale [72], as well as Zhao [69], have demonstrated how HEXACO provides increased nuance in understanding the interaction of these emotional dimensions with behavioral intentions. The advantage of this theoretically embedded trait approach allows researchers to study personality traits at a higher level of abstraction, enabling examination of the interplay of these individual differences with social and contextual factors, such as environmental attitudes and sociopolitical orientations, in ways that go beyond the explanatory power of the Big Five. The HEXACO model's honesty-humility and emotionality traits therefore offer a richer framework in the study of climate-related behaviors because they offer wider lenses through which personality-driven pro-environmental engagement could be better captured. This provides theoretical advancement that points to the relevance of moral and emotive dimensions, often missed by traditional personality models.

Recent research utilizing the HEXACO personality model has delivered insight into how personality traits influence attitudes and behaviors related to climate change [32,46,68,69,72,73]. For instance, Pickering and Dale [72], in 2023, investigated HEXACO traits in light of environmental values and climate change actions. Results indicated that the anxiety sub-facet of emotionality, inquisitiveness, and sociability were the strongest predictors of climate action. However, more interestingly, the anxiety trait moderated the relation between the environmental values and actions that were considered, underlining once again the importance of the emotional facets as motivational vectors of behavior. Brick and Lewis [46] focused on behaviors that reduce greenhouse gas emissions, with openness, conscientiousness, and extraversion being found to be the most significant predictors, with

environmental attitudes mediating these effects. This corresponds to the study conducted by Panno, De Cristofaro, Oliveti, Carrus, and Donati [73], where it was ascertained that openness and honesty-humility were the strongest predictors of climate change action and pro-environmental behavior. Further, moral anger mediated between openness and climate action, serving as an indication that certain emotional responses drive behavior.

Hopwood, Schwaba, Milfont, Sibley, and Bleidorn [32] used longitudinal data to illustrate how changes in the agreeableness and openness traits were associated with gains in SABs. The present study indicates that dynamic personality traits influence pro-environmental engagement with aging and as the individual adapts to new information. Similarly, Zhao [69] examined IWSB and found that honesty-humility, agreeableness, and conscientiousness were positively correlated with IWSB, while emotionality, extraversion, and openness demonstrated negative associations, implying that prosocial behaviors may require special personality profiles to be prompt effective involvement.

Soutter, Bates, and Mõttus [68], in their meta-analysis, combined evidence from both the Big Five and HEXACO models and found that openness and honesty-humility were the strongest correlates of pro-environmental attitude and behavior. This meta-analysis also noted that agreeableness, conscientiousness, and extraversion were other correlates of pro-environmental attitude and behavior, though associated with small effect sizes. The consistency of openness and honesty-humility has been evidenced across multiple studies. Cipriani, Frumento, Gemignani, and Menicucci [34] extended the meta-analysis to include country-level correlations between personality traits and climate change attitudes worldwide. As they pointed out, openness negatively relates to denial of climate change, whereas personality traits such as social dominance orientation and right-wing authoritarianism are associated positively with denial. This further underlines the relevance of openness and other prosocial traits, such as agreeableness, in encouraging concern for climate change along with active involvement.

The literature provides a series of converging results indicating openness and honest-humility to be strong predictors of pro-environmental behavior and climate action [32,34,68,69]. There are, however, variations based on emotional sub-facets, as elaborated on by Pickering, and contextual factors, such as socio-political environments, as explained by Cipriani, Frumento, Gemignani, and Menicucci [34]. Some contributions, for example, Zhao [69], have indicated that not all the HEXACO traits consistently support pro-environmental behaviors; for instance, emotionality and extraversion may be opposed to waste-sorting behavior. Integration of such findings may imply that interventions and communication strategies need to be matched, by using specific personality traits and emotional responses, to maximize effective engagement in pro-environmental actions. Despite the insights provided by these personality-focused studies, research employing HEXACO within the climate action framework remains limited.

While HEXACO provides a rather solid framework for pro-environmental behaviors, not all the traits are consistent predictors of positive environmental engagement. For example, Zhao pointed out that emotionality and extraversion sometimes could contrast with certain specific behaviors like sorting waste. Nevertheless, the variability observed across traits and behaviors suggests that HEXACO's application requires careful contextualization and targeted research. Despite the progress made, the application of HEXACO within the climate action framework remains underexplored, indicating a need for further research to deepen understanding of its implications for sustainability and behavioral change.

2.5. Social Media's Moderating Effect on Climate Action and Sustainable Consumption

The current literature on the impact of social media on the communication of climate change reveals its effect on public perception and, consequently, on sustainable consumer behavior [37,41,42,49,74]. However, findings indicate several complexities regarding this topic. León, Bourk, Finkler, Boykoff, and Davis [41] placed social media as the leading means in promoting discourse related to climate change, pointing out strategies for the efficient engagement of users on one hand, but also pointing out the challenge of

fostering deeper interaction on the other. In sum, they point to the limit of a knowledge-to-engagement gap in that, while social media might create awareness, it struggles hard to foster deeper and more meaningful forms of engagement. According to Tuitjer and Dirksmeier [74], social media influences the perception of climate efficacy in Europe. High usage of social media would therefore relate to a low perceived climate efficacy, especially on Facebook; this sets regional and platform-based differences in perceived efficacy. Variability across platforms suggests that not all platforms are created equal in fostering climate efficacy, possibly implying that over-reliance on certain platforms could potentially undermine public confidence in climate action. Nekmahmud, Naz, Ramkissoon, and Fekete-Farkas [38] and Alam, Ogiemwonyi, Alshareef, Alsolamy, Mat, and Azizan [40] provide proof that in the context of green consumer behavior, social media marketing of a green product significantly enriches the green purchase intention through the elements of TPB, including attitude, subjective norms, and perceived control, especially when it is supported by green thinking and environmental values. These findings suggest that tailored social media marketing strategies are useful but also point to their key limitation, with the latter being conditional on pre-existing environmental values and green thinking that not everyone may share.

Other scholars, such as Sun and Wang [37] and Wu and Long [42], also reveal that social media exerts a positive influence on green purchase intentions with the help of mediators such as green trust and perceived information usefulness. The study by Wu and Long [42] points to demographic differences; in this case, it turned out to have stronger effects for highly educated people and heavy social media users. Zahid, Ali, Ahmad, Thurasamy, and Amin [49] investigated these influences more closely, illustrating economic factors as moderators that impact consumer motivations toward green products in particular product categories. Through all these studies, social media is consistently found as being supportive of sustainable consumption behaviors by shaping environmental attitudes and awareness; however, mixed findings about perceived efficacy [74] and variations in the depth of engagement [41] suggest further scope for more tailored social media strategies in climate communication. Additionally, its effectiveness is uneven, often mediated by platform types, demographics, and economic contexts, suggesting that the utility of this as a universal strategy for promoting sustainable consumption is limited.

Overall, such findings point to both the potential and limitations of social media in developing more climate-conscious actions and sustainable consumption across diverse demographic and regional contexts [14,37,40,41]. Further research should be directed at determining how specific platforms, content types, and audience characteristics interact in such a way to maximize the effect of social media on pro-environmental behavior, by addressing both strengths and critical gaps.

This present study aims to summarize critical psychological, emotional, and personality-driven predictors of climate-related behaviors and, thus, inform existing knowledge gaps in the literature. This study combines climate change anxiety, emotional predictors like eco-guilt, and pro-environmental emotions with the HEXACO model of personality and provides a notion of how these variables influence climate action and sustainable consumption. While most studies either focus on an isolated construct or rely on the Big Five model, this study explores the integrated impact of HEXACO traits such as honesty-humility and emotionality on climate engagement. Overall, this research adds value by considering the role of social media usage as a moderator in the relationship besides direct experience with climate change and how it shapes and sometimes amplifies these relationships across demographic groups. This holistic approach fills the gaps in present findings and provides an integrative model for understanding pro-environmental behavior through the combined optics of personality, emotional response, and context influences. To address these relationships comprehensively, the following research questions guide the study:

RQ1: How do demographic factors, emotional predictors, nature-related factors, and personality traits contribute to intentions toward climate action (CCI) and sustainable consumption (SC)?

RQ2: How do interactions among emotional responses, nature-related factors, and personality traits influence intentions toward climate change intentions (CCI) and sustainable consumption (SC)?

RQ3: How do demographic factors and social media information (SMI) moderate the effects of emotional predictors and personality traits on intentions toward climate action intentions (CCI) and sustainable consumption (SC)?

RQ4: How do personality traits, social media influence (SMI), and climate-related emotional predictors interact to influence climate action intentions (CCI) and sustainable consumption (SC), particularly across different levels of education and age?

RQ5: How do emotional predictors (e.g., climate change worry and eco-guilt) mediate the relationship between personal experience of climate change (PER) and intentions toward climate action intentions (CCI) and sustainable consumption (SC)?

3. Research Methodology

3.1. Conceptual Model and Rationale

The present study has integrated HEXACO personality traits, emotional predictors of eco-guilt, eco-grief, and environmental empathy, along with anxiety about climate change, as key drives of pro-environmental behavior, while social media use is considered a moderator. Such a framework was developed with a view to investigating how these individual and contextual variables interact in shaping the intentions for sustainable consumption and climate action, besides offering an overall view of psychosocial drivers of pro-environmental behavior.

In this model, the theoretical underpinning borrows from insights into personality psychology, environmental psychology, and social media research. Of the HEXACO personality traits, honesty-humility and emotionality are expected to be critical in motivating the exhibition of pro-environmental behavior [23,34,72]. Inclusion of HEXACO extends the literature beyond the Big Five model, addressing the gap in research cited on trait-specific influences within the context of climate change. For instance, honesty-humility may enhance environmental care, whereas emotionality may trigger ecological awareness that leads to sustainable behavior. In addition, the emotional predictors of eco-guilt, eco-grief, and environmental empathy provide emotional states that reflect individual-level reactions to perceived climate change impacts and have been found to encourage behavior change for environmental betterment [26,35,36].

For instance, eco-guilt and eco-grief can motivate an individual to switch towards environmentally friendly choices; environmental empathy may raise one's level of concern about nature and foster care-oriented behaviours [26,35,36]. Climate change anxiety, another key element, is included to account for the specific psychological response to perceived environmental threats. This type of anxiety, characterized by feelings of distress and worry about the effects of climate change, can potentially act either to motivate or inhibit pro-environmental behaviours, depending on an individual's coping mechanisms [27,45,62,75]. Anxiety from climate change is included to reflect the rising interest in understanding the mental burdens derived from climate awareness and their impact on behavior. The social media usage included in the model as a moderator variable is alleged to enhance the impact of emotional and personality factors on pro-environmental behavior [18,21,52]. Social network sites offer active users a space to engage with climate-related content, take part in environmental advocacy, and connect with others, thereby strengthening emotional responses and personality trait influences on sustainable actions. The following model treats social media as a moderator in the relationship between individual psychological traits and climate-related behaviors, hence filling the current research gap surrounding the role of social media in environmental psychology [41,42,49,74]. In all, this approach provides a thorough examination of how personality traits and emotional responses, in conjunction with social media use, influence pro-environmental behaviors. The model provides valuable information regarding psychological and social drivers of

sustainable consumption and climate action intentions by anchoring key research gaps and expanding understanding within the climate action context, as illustrated in Figure 2.

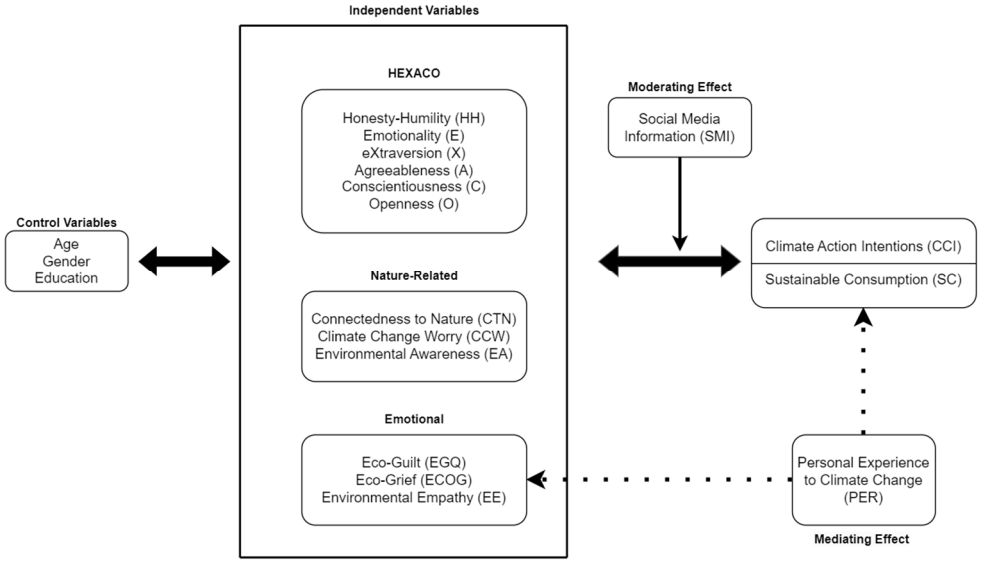

Figure 2. Conceptual model.

3.2. Data Collection and Sampling

This study employed a quantitative cross-sectional research design, appropriate for studying the relationships among several variables, in this case, HEXACO personality traits, climate change anxiety, social media use, and pro-environmental behaviors, assessed at a single point in time [76–78]. It allowed for a snapshot of how these factors interact in an existing context and hence was suited to exploratory analysis without the demands of longitudinal tracking [24,76,79,80]. A structured survey was used as the main instrument for data collection, wherein scales for each construct were validated [24,76,77]. Responses were collected using Google Forms due to its flexibility and ease of use, which enabled us to reach wide demographics. Data collection ranged from June 2024 to October 2024, during which we gathered a total of 604 responses. The targeted sample size was sufficient for statistical power in analyzing the relationships among the multiple variables; thus, techniques such as hierarchical regression analysis, generalized linear models, mediation, and moderation analysis were feasible. The target population included adults from diverse demographics, for whom climate-related behavior and the psychological motivators and deterrents surrounding such behavior were of interest. We sought a broad representation and a wide reach of participants with diverse age groups, levels of education, locations around the nation, and levels of engagement with environmental issues. Our sampling focused particularly on reaching both participants who were aware of climate action and those who could potentially be less involved to capture the range of perspective involved in climate action and sustainability intentions.

Given the exploratory nature of this study, the self-reporting instrument was chosen to examine the nature of these determinants interrelationships systematically. This questionnaire was developed and adapted from previously validated scales that fit into the context of this study, comprising a total of 68 items (see Appendix A, Table A1) alongside HEXACO-60 [81]. The instrument was structured into two parts: demographic data and scale measurements. The measurement section included sub-sections of HEXACO personality traits, anxiety due to climate change, eco-guilt, eco-grief, nature connectedness, using social media, and pro-environmental behavior.

To this end, to reach a diversified sample, we implemented snowball sampling, asking participants to distribute the questionnaire to their networks [82–84]. Snowball sampling is appropriate for exploratory studies and was used to reach out to diversified and often inaccessible populations, such as the climate-concerned youth, people from vulnerable

regions, and participants who may not be covered easily or accurately through random sampling. Even though snowball sampling is a non-probability technique, it is commonly used to reach participants that otherwise would not have been accessible, and helped us to gain a wider range of insights about climate-related behaviors, such as from youngsters involved in climate action and people from highly vulnerable areas because of climate change [82–84]. While snowball sampling does not achieve full representativeness, it serves well in exploratory research when trying to grasp diverse perspectives, particularly in those populations where the very possibility of reaching some subgroups is crucial for considering a wide spectrum of behavioral intentions. Responses for each of these items used a five-point Likert scale anchored from 1, strongly disagree, to 5, strongly agree, to assess the perceptions and behavior of the participants. To ensure the clarity, reliability, and validity of the survey items in this work, a pilot survey was conducted before its full deployment. The feedback received resulted in minor changes to increase the specificity and cultural relevance of some questions and make certain that the instrument was thematic for Greek auditors. Responses were anonymized to ensure confidentiality.

The questionnaires were circulated both online and physically via emails and professional networking sites to ensure that maximum coverage was achieved for participants across varied demographics [24,76,77]. After the collection of data, the completeness and normality of data were checked. This quantitative cross-sectional approach allowed for a systematic and in-depth study of the immediate relationships among HEXACO traits, emotional responses to climate change, and pro-environmental behaviors, thus setting a base for understanding these interactions within the Greek context.

3.3. Measurement Scales

Several validated instruments were adapted to measure the key constructs in this study. Sustainable consumption (SC) was measured with a three-item scale adapted from Severo, De Guimarães, and Dellarmelin [16], focusing on items related to how individuals have changed their consumption habits due to climate change, bought environmentally friendly products, and reduced the amount of waste produced because of climate change. Climate action intentions (CCI) were assessed with a three-item scale adapted from Zeier and Wessa [36], with items assessing citizens' intentions to engage in political involvement, activism, and environmentally protective behaviors to limit climate change impacts. From the climate change anxiety scale (CCAS), a scale developed by Clayton and Karazsia [18] to assess emotional responses to climate change, we specifically included measures to capture personal experience of climate change (PER), a three-item scale adapted from Clayton and Karazsia [18], assessing direct and indirect exposure to climate change impacts. The eco-guilt questionnaire (EGQ) was assessed through an 11-item scale adapted by Ágoston, Urban, Nagy, Csaba, Kőváry, Kovacs, Varga, Dull, Monus, and Shaw [21] and Zeier and Wessa [36], measuring personal responsibility, environmental behaviors, and subjective guilt concerning climate-related behavior. Environmental empathy (EE) was assessed through a four-item scale from Tam [85] and Zhou and Wang [86], reflecting empathy and care for the natural world and its inhabitants. Eco-grief (ECOG) was measured by the specific six-item scale adapted from Ágoston, Urban, Nagy, Csaba, Kőváry, Kovacs, Varga, Dull, Monus, and Shaw [21] and Zeier and Wessa [36]. Items tapped into negative feelings, sadness, and a sense of loss about climate change impacts in local and global ecosystems. For the nature/climate predictors, we included the connectedness to nature scale (CTN), a 13-item scale adapted from Reese, Rueff, and Wullenkord [27] and Mayer, Frantz, Bruehlman-Senecal, and Dolliver [44], which is a measure into the participant's feelings of unity and interconnectedness with nature. The scale on environmental awareness (EA) was devised based on a six-item scale adapted from Severo, De Guimarães, and Dellarmelin [16], with items related to the reduction of waste, water conservation, and awareness with regard to climate change. Climate anxiety was measured using the climate change worry scale (CCW), which was adapted from Stewart [54]. It contained 10 items that assessed worries about future impacts, media-seeking behaviors, and concerns over severe

weather. Social media marketing information (SMI) was measured by a nine-item scale adapted from Wu and Long [42] in areas such as promoting green products through social media, disseminating information through it, and accessing updates on environmental products in an easy and engaging manner.

3.4. Sample Profile

The sample was representative of a diverse population in terms of gender, age, and educational background, with a total of 604 participants. The sample was gender-balanced, with males making up 51.7% of the sample, and females making up 48.3%. In the context of age, the largest group included those individuals within the range of 26–30 years of age at 39.2%, or N = 237, followed by the ranges of 31–40 years with 25.0%, or N = 151, and 18–25 years with 23.3%, or N = 141. The remaining the age groups were the 41–59 age group, comprising 10.4% (N = 63), and the 60+ category, comprising 2.0% (N = 12). Regarding education, the majority of the group held either a Bachelor's degree, at 36.1% (N = 218), a high school diploma, at 29.3% (N = 177), or a Master's degree, at 26.7% (N = 161). The doctoral level included PhD candidates 3.8% (N = 23) and those holding a doctoral degree 4.1% (N = 25). A look at this distribution develops a varied sample, which can be valuable in terms of perspectives across demographic lines that might affect the findings of key variables regarding the study. A summary of the sample demographics can be observed in Table 1.

Table 1. Sample profile.

		Frequency (N)	Percentage
Gender	Male	312	51.7%
	Female	292	48.3%
Age	18–25	141	23.3%
	26–30	237	39.2%
	31–40	151	25.0%
	41–59	63	10.4%
	60+	12	2.0%
Education	High School	177	29.3%
	Bachelor's Degree	218	36.1%
	Master's Degree	161	26.7%
	PhD Candidate	23	3.8%
	Doctoral	25	4.1%

4. Data Analysis and Results

Data analysis was performed in the Google Colab environment, which enabled efficient processing of the statistical models applied in this study [87]. The variables in this study have been analyzed using composite scores derived from multiple items rather than using each item individually. Where mean scores are calculated from multi-item scales, this common approach enables streamlined analysis while maintaining the depth and robustness offered by multi-item constructs. We summated these items into one composite score to get the overall dimension of the variable without making the analysis too intricate, and to balance our thoroughness with clarity without compromising the depth of insights [16,27,54,75]. First of all, tests for common method bias were conducted to ensure that the observed relationships were not highly susceptible to the method of measurement, thus laying the groundwork for reliable results. Preliminary analyses, including correlations, t-tests, and ANOVAs, were performed to explore the relationships among key variables, such as psychological traits, emotional predictors, and demographic factors (age, gender, and education), concerning climate change intentions (CCI) and sustainable consumption (SC). These initial analyses helped provide an overview of how each factor relates to the outcomes of interest. We followed this with hierarchical regression models to test the incremental predictive capability of independent variables on CCI and SC.

Hierarchical regression allowed us to assess how much variance was explained by each set of predictors, particularly personality traits and emotional predictors, as each block of variables entered into the model. For a subtler analysis of the interaction and relationship complexities among predictors, generalized linear models were employed. GLMs allowed us to consider interactions between demographic subgroups and continuous variables without the need for non-parametric adjustment, as the assumptions of normality, linearity, and multicollinearity were fulfilled by the data. Finally, mediation analyses using the PROCESS macro in Python examined the indirect effects of PER on CCI and SC through CCW and EGQ. This approach allowed examining complex mediational pathways with bootstrap confidence intervals of the indirect effects, thus enhancing robustness. Since all questions put in the Google Forms survey were made mandatory, there were no missing data. Also, all the statistical assumptions were met, hence giving accurate and reliable results. The combination of such statistical methods, from preliminary tests to advanced modelling, provided an integrated approach toward the understanding of psychological and social factors leading to pro-environmental behaviours, allowing insight into how traits, emotions, and demographic factors interact. An illustration of the workflow is depicted in Figure 3.

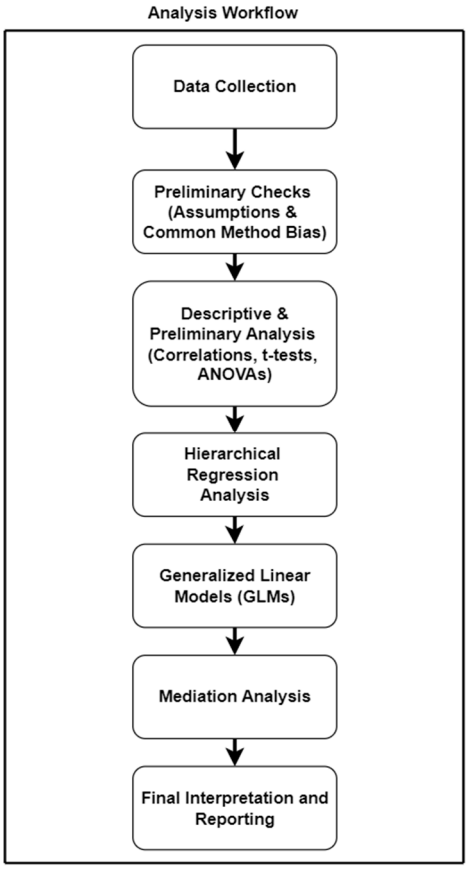

Figure 3. Analysis workflow.

4.1. Preliminary Analysis

4.1.1. Common Method Bias

Following Podsakoff et al.'s [88] methodological indications, with the purpose of ensuring from our study the validity and accuracy of the constructs measuring latent variables, an extensive assessment for common method bias, or CMB, was performed [89]. First, Harman's single-factor test was conducted to determine if a single factor accounted for the majority of variance in the model. The results of the unrotated principal factor analysis indicated that the general factor explained 17.55% of the total variance, which is well below the critical threshold of 50%. Therefore, CMB was not a problem in our study.

4.1.2. Group Comparisons and Demographic Differences

A Pearson correlation analysis was performed to explore the relationships among the different psychological traits, demographic factors, and behavioral intentions with respect to climate change and sustainable consumption. The correlation analysis results are shown in Table 1 below, reporting the correlation coefficients along with their *p*-values.

The interrelations between personality traits were the most substantial, with honesty-humility being positively related to agreeableness (r = 0.13, $p < 0.001$) and openness (r = 0.15, $p < 0.001$). This would, therefore, imply that people with high honesty-humility are more likely to act in a pro-social manner. On the other hand, emotionality correlated negatively with honesty-humility, with a non-significant value of r = −0.00 and $p = 0.998$, and a significantly weak positive correlation with extraversion with values of r = −0.05 and $p = 0.268$. Thus, it appears that emotional traits may not be directly related to humility; these traits may instead relate to extroversion. A strong positive correlation was found on behavioral intentions between SC and CCI (r = 0.73, $p < 0.001$). This indicates that the higher the intention of people for climate action, the higher their sustainable consumption behavior. Furthermore, SC was positively related to EGQ scores (r = 0.46) and the *p*-value was less than 0.001, which indicated that the more a person develops guilt surrounding environmental issues, the more they are likely to be inclined towards sustainable consumption. Emotional predictor analysis showed that ECOG was related negatively with SC (r = −0.17, $p < 0.001$), suggesting that as eco-grief increases, SC may become less prominent. EE was only marginally significantly negatively related to SC (r = −0.08, $p = 0.055$), with the implication that greater empathy might not be associated with more sustainable consumption. Education was significantly negatively correlated with SC (r = −0.19, $p < 0.001$) and CCI (r = −0.09, $p = 0.030$), indicating that sustainable consumption and action on climate issues become weaker as education level lowers. Exploring the correlations of gender, there was a strong negative association with SC (r = −0.10, $p = 0.010$) suggesting real gender differences with respect to sustainable consumption. The results are illustrated in Figure 4.

More precisely, the correlation analysis revealed very complex interrelations among the psychological traits, emotional responses, demographic factors, and behaviors concerning climate change and sustainability. All the findings place into prominence the important role that emotional predictors of eco-guilt and eco-grief, as well as personality traits and demographic characteristics, play in shaping intentions related to climate change and engagement in sustainable consumption. For this purpose, interventions targeting either of the emotional or personality components should be developed to build pro-environmental behaviors.

Following the correlation analysis, which identified various relationships between personality traits, emotional factors, and behavioral intentions, a series of *t*-tests were conducted to examine potential gender differences in climate change intentions (CCI) and sustainable consumption (SC) [90]. For CCI, Levene's test indicated unequal variances, ($F(1, 602) = 5.72$, $p = 0.017$), so Welch's t-test was used. The results revealed no significant difference between males (M = 3.95, SD = 0.55, N = 312) and females (M = 3.94, SD = 0.59, N = 292) on CCI, $t(602) = 0.291$, $p = 0.771$, d = 0.29, with a 95% confidence interval for the mean difference of [−0.08, 0.11]. For SC, Levene's test showed equal variances ($F(1, 602) = 1.03$, $p = 0.310$), and a standard *t*-test was conducted. The results indicated a significant difference between males (M = 4.20, SD = 0.62, N = 312) and females (M = 4.07, SD = 0.60, N = 292), $t(602) = 2.57$, $p = 0.010$, d = 0.21, with a mean difference of 0.13 and a 95% confidence interval of [0.03, 0.23].

Building on the gender differences observed, ANOVA was employed to assess whether age had any significant effects on CCI and SC [91]. For CCI, no significant differences were observed between age groups ($F(4, 599) = 0.992$, $p = 0.411$, $\eta^2 = 0.007$). Group means and standard deviations were as follows: 18–25 (M = 4.00, SD = 0.57), 26–30 (M = 3.96, SD = 0.55), 31–40 (M = 3.91, SD = 0.57), 41–59 (M = 3.91, SD = 0.61), and 60+ (M = 3.72, SD = 0.60). For SC, the ANOVA also showed no significant age differences, ($F(4, 599) = 1.934$, $p = 0.103$,

η^2 =0.013). Group means and standard deviations were: 18–25 (M = 4.25, SD = 0.67), 26–30 (M = 4.10, SD = 0.60), 31–40 (M = 4.07, SD = 0.57), 41–59 (M = 4.18, SD = 0.62), and 60+ (M = 4.03, SD = 0.67).

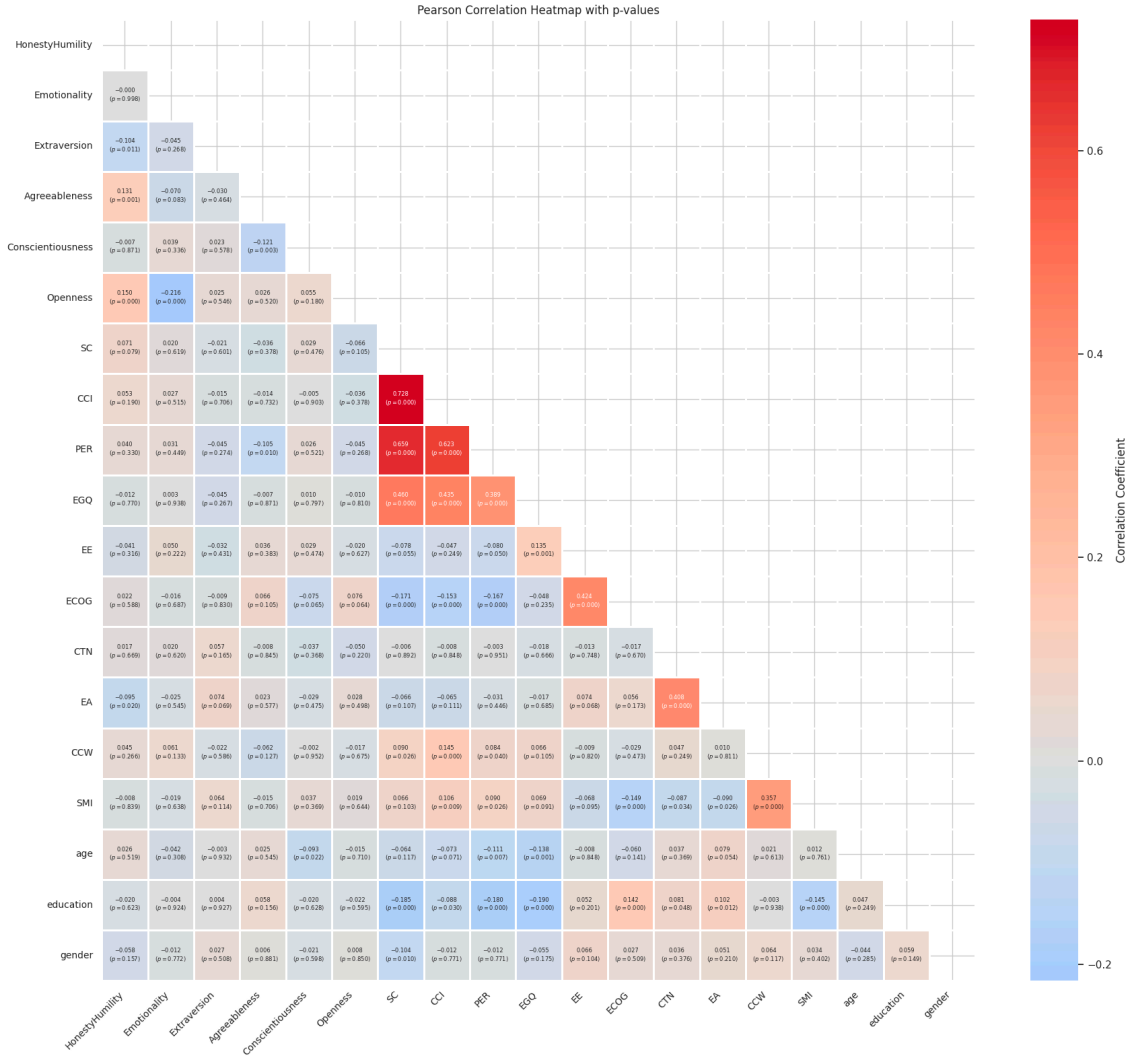

Figure 4. Pearson correlation map.

Expanding the analysis to educational differences, for CCI, a significant effect of education level was found (F(4, 599) = 5.733, $p < 0.001$, $\eta^2 = 0.037$). Post-hoc comparisons using Tukey's HSD indicated significant differences between high school vs. doctoral (adjusted $p < 0.05$, difference = −0.441), bachelor's degree vs. doctoral (adjusted $p < 0.05$, difference = −0.487), and master's degree vs. doctoral (adjusted $p < 0.05$, difference = −0.519). For SC, the ANOVA showed a significant effect of education level (F(4, 599) = 5.686, $p < 0.001$, $\eta^2 = 0.037$). Significant post-hoc differences were found between high school vs. doctoral (adjusted $p < 0.05$, difference = −0.494), high school vs. PhD candidate (adjusted $p < 0.05$, difference = −0.399), and bachelor's degree vs. doctoral (adjusted $p < 0.05$, difference = −0.391). The results are depicted in Table 2.

To further investigate, two-way ANOVA was conducted for each dependent variable [92]. In the case of CCI, the results revealed no significant main effect of age (F(4, 594) = 1.01, $p = 0.399$) and no significant main effect of gender (F(1, 594) = 0.15, $p = 0.696$). There was also no significant interaction effect of age and gender on CCI (F(4, 594) = 1.93, $p = 0.104$). The SC two-way ANOVA resulted in a significant main effect for gender only (F(1594) = 6.37, $p = 0.012$); this shows that gender is a significant determinant of SC. The main effect of age was not significant (F(4, 594) = 1.88, $p = 0.112$),

and the interaction of age with gender did not reach a significant level ($F(4, 594) = 1.03$, $p = 0.393$). This indicates that gender is a significant determinant of SC, while age and also the interaction of age and gender are not determinants of CCI or SC.

Table 2. Significant differences: results for gender and education.

Measure	Group 1 (M, SD)	Group 2 (M, SD)	F(df)	*p*-Value	η^2
Gender Diff.					
CCI	Male (3.95, 0.55)	Female (3.94, 0.59)	F(1, 602) = 5.72	0.017	0.007
SC	Male (4.20, 0.62)	Female (4.07, 0.60)	F(1, 602) = 2.57	0.010	0.021
Education Diff.					
CCI	High School (3.93, 0.48)	Doctoral (3.49, 0.67)	F(4, 599) = 5.733	<0.001	0.037
	Bachelor's Degree (3.98, 0.60)	Doctoral (3.49, 0.67)			
	Master's Degree (4.01, 0.57)	Doctoral (3.49, 0.67)			
SC	High School (4.25, 0.64)	Doctoral (3.76, 0.66)	F(4, 599) = 5.686	<0.001	0.037
	High School (4.25, 0.64)	PhD Cand. (3.86, 0.63)			
	Bachelor's Degree (4.15, 0.62)	Doctoral (3.76, 0.66)			

4.2. Hierarchical Modelling

Following the preliminary analyses, which showed significant gender and educational differences in CCI and SC, hierarchical regression models were estimated to explore in greater depth the predictors of these behaviors. Hierarchical modeling enables the sequential and systematic introduction of variables and hence the possibility of understanding how demographic factors, emotional predictors, nature-related factors, and personality traits contribute to climate action and consumption patterns [93,94]. The present analysis will, therefore, yield precious insights into the relative importance of each set of predictors, since at each step it evaluates the incremental variance explained, thus illuminating the complex interplay between individual characteristics and emotional responses in shaping pro-environmental behaviors. The following sections will present the results from these hierarchical models and describe the respective contributions of various predictors to both CCI and SC.

To examine the factors influencing climate change intention (CCI), four hierarchical regression models were conducted. In Model 1, demographic controls (age, education, gender) explained minimal variance ($R^2 = 0.013$, $p = 0.0528$), with only education showing a small, negative effect on CCI. Adding emotional predictors in Model 2 significantly increased explained variance ($R^2 = 0.210$, $p < 0.001$), where environmental guilt (EGQ) had a strong positive effect ($\beta = 0.598$, $p < 0.001$), and eco-grief (ECOG) had a small negative effect ($\beta = -0.126$, $p = 0.008$). In Model 3, nature/climate predictors (including climate anxiety and environmental awareness) further raised explained variance ($R^2 = 0.225$, $p < 0.001$). Here, climate change worry (CCW) showed a small but positive association with CCI ($\beta = 0.120$, $p = 0.002$). Finally, Model 4 introduced personality traits (HEXACO dimensions), slightly increasing explained variance to $R^2 = 0.229$. Notably, honesty-humility showed a small positive association ($\beta = 0.047$, $p = 0.133$), though not reaching significance. In all, the findings indicate that emotional predictors and nature/climate predictors significantly contribute to explaining variances in climate change intention, with environmental empathy and eco-guilt being the most influential, while personality traits and demographics are minimally influential. These results highlight emotional and environmental connections as central in the understanding of CCI (Table 3).

A second hierarchical regression analysis was conducted to assess the effects of control variables, emotional predictors, nature/climate predictors, and personality traits on sustainable consumption (SC). Model 1 included control variables (age, education, gender), accounting for 4.7% of the variance in SC, $R^2 = 0.047$, $F(3, 600) = 9.79$, $p < 0.001$. Education ($\beta = -0.106$, $p < 0.001$) and gender ($\beta = -0.118$, $p = 0.016$) significantly predicted SC. Model 2 added emotional predictors, significantly increasing explained variance to

25.2%, $\Delta R^2 = 0.205$, F(6, 597)= 33.55, $p < 0.001$. Significant predictors included ECOG ($\beta = -0.125$, $p = 0.012$), EGQ ($\beta = 0.658$, $p < 0.001$), and EE ($\beta = -0.097$, $p = 0.028$). In Model 3, nature/climate predictors were introduced, increasing the variance explained to 25.8%, $\Delta R^2 = 0.006$, F(9, 594) = 22.91, $p < 0.001$. CCW was partially significant ($\beta = 0.070$, $p = 0.086$). Model 4 included personality traits, further improving explained variance to 26.7%, $\Delta R^2 = 0.009$, F(15,588) = 14.26, $p < 0.001$. Honesty-humility ($\beta = 0.071$, $p = 0.033$) was a significant predictor. Emotional predictors provided the strongest explanation of SC, with nature/climate and personality traits adding additional insights (Table 4).

Table 3. Hierarchical regression analysis results for CCI dependent variable.

Model	R^2	ΔR^2	F-Statistic	Predictor	Coeff. (β)	*p*-Value	b (95% CI)
Model 1	0.013	—	2.579	Gender	−0.245	0.807	−0.0114 (−0.103, 0.080)
				Education	−2.078	0.038 *	−0.0469 (−0.091, −0.003)
				Age	−1.72	0.086	−0.0399 (−0.085, 0.006)
Model 2	0.21	0.197	26.50 ***	ECOG	−2.66	0.008 **	−0.1264 (−0.220, −0.033)
				EGQ	11.525	<0.001 ***	0.5983 (0.496, 0.700)
				EE	−1.524	0.128	−0.0635 (−0.145, 0.018)
Model 3	0.225	0.015	19.20 ***	CCW	3.084	0.002 **	0.1196 (0.043, 0.196)
				CTN	0.337	0.737	0.0156 (−0.075, 0.106)
				EA	−1.375	0.17	−0.0498 (−0.121, 0.021)
Model 4	0.229	0.004	11.66 ***	HH	1.503	0.133	0.0473 (−0.015, 0.109)
				A	−0.061	0.952	−0.0016 (−0.053, 0.050)
				E	0.348	0.728	0.0113 (−0.053, 0.075)
				X	0.377	0.706	0.0099 (−0.041, 0.061)
				C	−0.474	0.636	−0.0135 (−0.069, 0.042)
				O	−0.696	0.487	−0.0218 (−0.083, 0.040)

Notes: Standardized betas (*β*) are reported for all predictors in each step. Degrees of freedom and residuals (df1, df2) are as follows: (3, 600) in Step 1, (6, 597) in Step 2, (9, 594) in Step 3, and (15, 588) in Step 4. Confidence intervals (CI) are given in parentheses for unstandardized coefficients (*b*). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4. Hierarchical regression analysis results for SC dependent variable.

Model	R^2	ΔR^2	F-Statistic	Predictor	Coeff. (β)	*p*-Value	b (95% CI)
Model 1	0.047	–	9.786 **	Gender	−2.411	0.016 *	−0.118 (−0.215, −0.022)
				Education	−4.424	<0.001 ***	−0.106 (−0.153, −0.059)
				Age	−1.497	0.135	−0.037 (−0.085, 0.011)
Model 2	0.252	0.205	33.55 ***	ECOG	−2.518	0.012 *	−0.125 (−0.223, −0.028)
				EGQ	12.096	<0.001 ***	0.658 (0.551, 0.765)
				EE	−2.209	0.028 *	−0.097 (−0.182, −0.011)
Model 3	0.258	0.006	22.91 ***	CTN	0.613	0.54	0.030 (−0.066, 0.126)
				EA	−1.151	0.25	−0.044 (−0.119, 0.031)
				CCW	1.72	0.086	0.070 (−0.010, 0.151)
Model 4	0.267	0.009	14.26 ***	HH	2.134	0.033 *	0.071 (0.006, 0.136)
				E	−0.016	0.987	−0.001 (−0.068, 0.067)
				X	0.245	0.806	0.007 (−0.047, 0.061)
				A	−0.574	0.566	−0.016 (−0.069, 0.038)
				C	0.488	0.625	0.015 (−0.044, 0.073)
				O	−1.829	0.068	−0.060 (−0.125, 0.004)

Notes: Standardized betas (β) are reported. Degrees of freedom and residuals (df1, df2) were (3, 600) in Step 1, (6, 597) in Step 2, (9, 594) in Step 3, and (15, 588) in Step 4. Confidence intervals (CI) are given in parentheses for unstandardized coefficients (b). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In summary, predictors for CCI and SC, based on a hierarchical regression analysis, were considered using four different models. In Model 1, considering control variables, education significantly predicted both CCI and SC, while gender was only significant for

SC; hence, demographic factors influence sustainable behaviors. Model 2, considering emotional predictors, accounted for significant additional variance in both models. Emotional guilt positively predicted CCI (b = 0.35, $p < 0.001$ and SC: b = 0.30, $p < 0.001$), while environmental empathy was negatively associated (ECOG: b = −0.43, $p < 0.001$ (CCI), and b = −0.41, $p < 0.001$ added substantial variance to the models, underlining the impact of emotional responses on climate behaviors. In Model 3, nature/climate Predictors accounted for additional variance in both outcomes. CCW partially reached significance for CCI (b = 0.14, $p < 0.01$) and SC (b = 0.13, $p < 0.05$), showing it has a moderate influence on intentions. Finally, Model 4 (personality traits) showed that honesty-humility uniquely predicted SC, underlining the hypothesis that personality traits may shape the variation in SC intentions more than in climate-related ones. In general, emotional predictors most strongly affected both models, with nature predictors and personality traits more specifically influencing SC.

4.3. Interaction Effects with Generalized Linear Models (GLMs)

4.3.1. Direct Effects Models for Emotional, Nature/Climate, and Personality Predictors

Generalized linear models were conducted to test the predictive influence of emotional, nature/climate-related predictors, and HEXACO personality traits on climate change action (CCI) and sustainable consumption (SC). GLMs with a Gaussian identity link function were preferred, as they represent the state-of-the-art analytical developments for continuous normally distributed variables in behavioral data modeling [95–99]. The framework allows for an in-depth understanding of how emotional responses, environmental awareness, and personality traits of individuals interact in influencing pro-environmental behavior, thus providing insights into the underlying mechanisms driving climate action and sustainable consumption.

This approach allowed for proper estimates of categorical predictors and interactions and resulted in a moderate explanatory power ($R^2 = 0.25$ for CCI and $R^2 = 0.2873$ for SC). For CCI, eco-grief (ECOG) was negative with b = −0.119, SE = 0.047, z = −2.523, $p = 0.012$, and a 95% CI [−0.212, −0.027]. EGQ had a strong positive impact on CCI (b = 0.587, SE = 0.050, z = 11.684, $p < 0.001$, 95% CI [0.489, 0.686]), suggesting that greater eco-guilt intensity is related to more climate action engagement. CCW exerted a positive influence on CCI as well (b = 0.116, SE = 0.039, z = 2.993, $p = 0.003$, 95% CI [0.040, 0.193]). For SC, ECOG had a significant negative influence (b = −0.124, SE = 0.050, z = −2.491, $p = 0.013$, 95% CI [−0.222, −0.027]). EGQ positively influenced SC (b = 0.683, SE = 0.053, z = 12.855, $p < 0.001$, 95% CI [0.579, 0.787]), whereas environmental empathy (EE) was negatively associated with SC (b = −0.102, SE = 0.044, z = −2.313, $p = 0.021$, 95% CI [−0.188, −0.016]). It was positively related to honesty-humility (b = 0.075, SE = 0.033, z = 2.272, $p = 0.023$, 95% CI [0.010, 0.140]). These findings indicate a differential influence of emotional, climate, and personality aspects on variation in climate action and sustainable consumption (Table 5).

Table 5. Significant results for direct effects.

DV	Predictor	Coeff. (b)	SE	z-Value	*p*-Values	95% CI
CCI	ECOG	−0.119	0.047	−2.523	0.012	[−0.212, −0.027]
	EGQ	0.587	0.050	11.684	<0.001	[0.489, 0.686]
	CCW	0.116	0.039	2.993	0.003	[0.040, 0.193]
SC	ECOG	−0.124	0.050	−2.491	0.013	[−0.222, −0.027]
	EGQ	0.683	0.053	12.855	<0.001	[0.579, 0.787]
	EE	−0.102	0.044	−2.313	0.021	[−0.188, −0.016]
	Honesty-Humility	0.075	0.033	2.272	0.023	[0.010, 0.140]

4.3.2. Demographic Interactions with Emotional and Personality Traits (Two-Way Interactions)

Based on the preliminary analysis results showing that there are considerable variations in CCI and SC between genders and educational levels, further investigations regarding the interaction of emotional predictors with nature/climate factors and personality traits were performed. Thus, to realize this, GLMs were used to investigate the interaction between the mentioned predictors and demographics with their effects on CCI and SC. The models utilized a Gaussian identity link function, with the CCI model demonstrating a R^2 of 0.2714 and the SC model showing a R^2 of 0.3188. For CCI, eco-guilt (EGQ) was not significantly associated (b = −0.0610, SE = 0.067, z = −0.904, p = 0.366), while eco-grief (ECOG) had a significant positive effect (b = 0.7476, SE = 0.075, z = 9.925, $p < 0.001$, 95% CI [0.600, 0.895]). Additionally, gender significantly moderated the relationship between EGQ and CCI (b = −0.2831, SE = 0.102, z = −2.763, p = 0.006, 95% CI [−0.484, −0.082]). Climate change awareness (CCW) positively influenced CCI (b = 0.1129, SE = 0.039, z = 2.876, p = 0.004, 95% CI [0.036, 0.190]).

For SC, eco-guilt (EGQ) also showed a non-significant negative effect (b = −0.1081, SE = 0.071, z = −1.526, p = 0.127). In contrast, eco-grief (ECOG) had a significant positive impact (b = 0.8552, SE = 0.079, z = 10.816, $p < 0.001$, 95% CI [0.700, 1.010]). Gender moderated the effect of EGQ on SC (b = −0.3497, SE = 0.108, z = −3.251, p = 0.001, 95% CI [−0.560, −0.139]). Additionally, honesty-humility positively influenced SC (b = 0.1683, SE = 0.065, z = 2.573, p = 0.010, 95% CI [0.040, 0.296]), while openness showed a significant negative association (b = −0.0674, SE = 0.033, z = −2.032, p = 0.042, 95% CI [−0.132, −0.002]) (Table 6).

Table 6. Significant results for the two-way interactions (education, gender).

DV	Predictor	Coeff. (b)	SE	z-Value	*p*-Value	95% CI
CCI	EGQ	0.7476	0.075	9.925	<0.001	[0.600, 0.895]
	Gender × EGQ	−0.2831	0.102	−2.763	0.006	[−0.484, −0.082]
	CCW	0.1129	0.039	2.876	0.004	[0.036, 0.190]
SC	EGQ	0.8552	0.079	10.816	<0.001	[0.700, 1.010]
	Gender × EGQ	−0.3497	0.108	−3.251	0.001	[−0.560, −0.139]
	Honesty-Humility	0.1683	0.065	2.573	0.010	[0.040, 0.296]
	Openness	−0.0674	0.033	−2.032	0.042	[−0.132, −0.002]

Indeed, the large positive association of EGQ and CCI (b = 0.7476, $p < 0.001$) indicates that a greater magnitude of eco-guilt is associated with increased climate action. This positive result brings into focus the emotional burden of concerns related to the environment, which might provide motivation for proactive behaviors. On the other hand, ECOG did not vary significantly with CCI, which underpins a possible differentiation in the role of grief and feelings of guilt related to action intentions. Interaction of gender with eco-guilt (b = −0.2831, p = 0.006) points to nuances in how emotional experiences about climate are associated with intended climate action by gender. This invites one to consider demographic factors when assessing the influence of emotions on behavior.

In turn, for SC, the positive influence of honesty-humility was at b = 0.1683, p = 0.010, which showed that with increasing scores for this personality trait, there would be more sustainable consumption behaviors. This shows how crucial personality traits are in terms of determining environmental behavior, and perhaps also how valuable the development of such a trait could be in encouraging sustainability. The analysis of gender as a moderating factor produces some interesting variants in how eco-guilt operates on CCI and SC. To explain these findings, we plotted the interaction effect of gender and eco-guilt on CCI and SC. These allow a more detailed understanding of exactly how emotional factors, such as eco-grief, interact with demographic variables like gender to influence pro-environmental behavior.

From the interaction plots, we can see that there is a positive association between eco-guilt and both CCI and SC for both males and females. These visualizations highlight that

this association is somewhat stronger for males than for females as the levels of eco-guilt increase. More specifically, when eco-guilt increases, males show a higher increase in both climate change intentions and sustainable consumption compared to females. Each plot also conveys variability and strength across genders by reporting the confidence interval of the association in Figures 5 and 6.

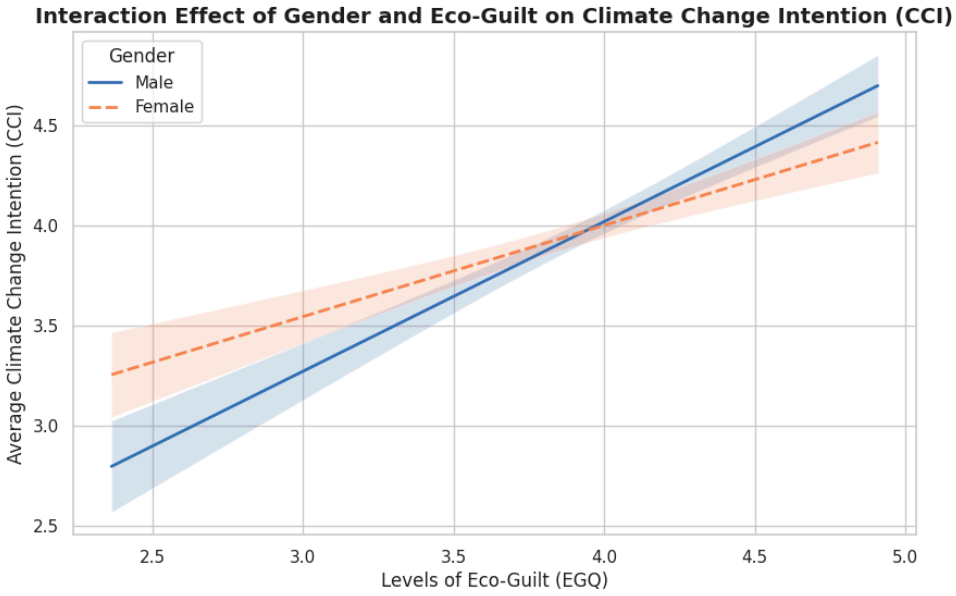

Figure 5. Plot illustration of the interaction between gender and eco-guilt (EGQ) on average climate change intention (CCI) at 95% CI.

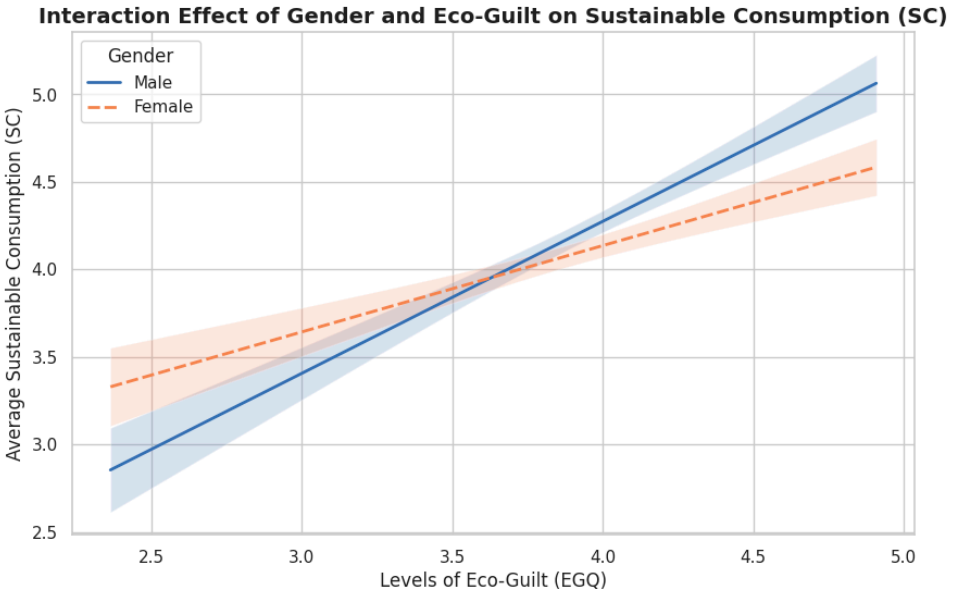

Figure 6. Plot illustration of the interaction between gender and eco-guilt (EGQ) on average sustainable consumption (SC) at 95% CI.

4.3.3. Three-Way Interaction Analysis Between Personality Traits, Social Media Use, and Climate Anxiety on SC and CCI

Generalized linear model analysis was conducted to examine the three-way interaction effects of the emotional predictors with social media influence and demographic factors of education and age, which had been proven significant from the preliminary analysis, to further investigate the dynamics driving CCI and SC. This analysis employed a Gaussian

identity link and full set of predictors to investigate how the variables combined in affecting climate-related behaviors of individuals.

For CCI, the model accounted for approximately 27.33% of the variance (R^2 = 0.2733) indicating a moderate explanatory power for the predictors included in the model. The model's significant findings included, climate change worry (CCW) was positively associated with CCI (B = 0.104, SE = 0.042, z = 2.484, p= 0.013), suggesting that higher levels of climate change worry are associated with stronger intentions toward climate action (95% CI [0.022, 0.187]). Other predictors, including eco-grief (ECOG), eco-guilt (EGQ), environmental empathy (EE), connectedness to nature (CTN), environmental awareness (EA), and all HEXACO personality traits, did not yield statistically significant effects on CCI (all $p > 0.05$). Additionally, no significant three-way interactions emerged for the combinations of ECOG, SMI, and gender or EGQ, SMI, and age.

For SC, the model explained approximately 32.87% of the variance (R^2 = 0.3287), indicating a moderate level of predictive accuracy. Significant findings included environmental empathy (EE) being negatively associated with SC (B = −0.096, SE = 0.044, z = −2.202, p = 0.028), suggesting that greater empathy was associated with lower sustainable consumption scores (95% CI [−0.181, −0.011]). Education had a positive effect on SC (b = 2.624, SE = 1.291, z = 2.034, p = *0*.042), indicating that higher levels of education are linked with increased sustainable consumption (95% CI [0.095, 5.154]). The interaction between SMI and education was significant (b = −0.639, SE = 0.316, z = −2.024, p = 0.043), indicating that the impact of education on sustainable consumption may vary depending on social media information levels (95% CI [−1.257, −0.020]). Marginally significant findings were observed for honesty-humility (b = 0.063, SE = 0.033, z = 1.904, p= 0.057, 95% CI [−0.002, 0.129]) and openness (b = −0.063, SE = 0.033, z = −1.906, p = 0.057, 95% CI [−0.127, 0.002]), suggesting these personality traits may have weak associations with sustainable consumption.

In overall analyses, the results suggested that the leading predictor of climate action intentions was worry about climate change, and empathy, education, and social media information predicted sustainable consumption. No three-way interactions were significant across models (Table 7).

Table 7. Significant results in the presence of three-way interactions (SMI, age, education).

DV	Predictor	Coeff. (b)	SE	z-Value	*p*-Value	95% CI
CCI	CCW	0.104	0.042	2.484	0.013	[0.022, 0.187]
SC	EE	−0.096	0.044	−2.202	0.028	[−0.181, −0.011]
	Education	2.624	1.291	2.034	0.042	[0.095, 5.154]
	SMI × Education	−0.639	0.316	−2.024	0.043	[−1.257, −0.020]
	Honesty-Humility (Marg.)	0.063	0.033	1.904	0.057	[−0.002, 0.129]
	Openness (Marg.)	−0.063	0.033	−1.906	0.057	[−0.127, 0.002]

The results report distinct predictors for CCI and SC, pointing out how worry about climate change, empathy, and education drive pro-environmental behavior. In fact, CCW significantly enhances the intention to act for climate causes. Presumably, emotional concern could be a driving force for behavioral commitment to climate causes. Whereas education and empathy are important precursors of SC, on the contrary, environmental empathy is considered much more important in cases when the scores of SC are low. This again might be a reflection of a more involved relationship, whereas empathetic concern does not always turn into sustainable consumer choice. The interaction between education and social media information may suggest that social media exposure might change the effect of educational influences on consumption by underlining, in a nuanced way, the role of digital sources of information. These results imply that different underlying psychological and social factors underpin the intentions about climate action and those about sustainable consumption and point to the need for climate communication and education strategies that are tailored

for the promotion of specific pro-environmental behaviors. To visualize the results, we have plotted the interaction effect of education level and social media information (SMI) on predicted sustainable consumption (SC) in Figure 7. This is evidenced by the trend, where the higher SMI generally enjoys a decline in sustainable consumption with an increase in education level, but the trend at the doctoral level slightly bounces. On the other hand, those in the group comprising lower SMI tend to have fully declined levels of sustainable consumption as the education level increases. This interaction implies that, in fact, the level of exposure to social media information acts as a moderator in the relationship between education and sustainable consumption, with different patterns across different levels of SMI.

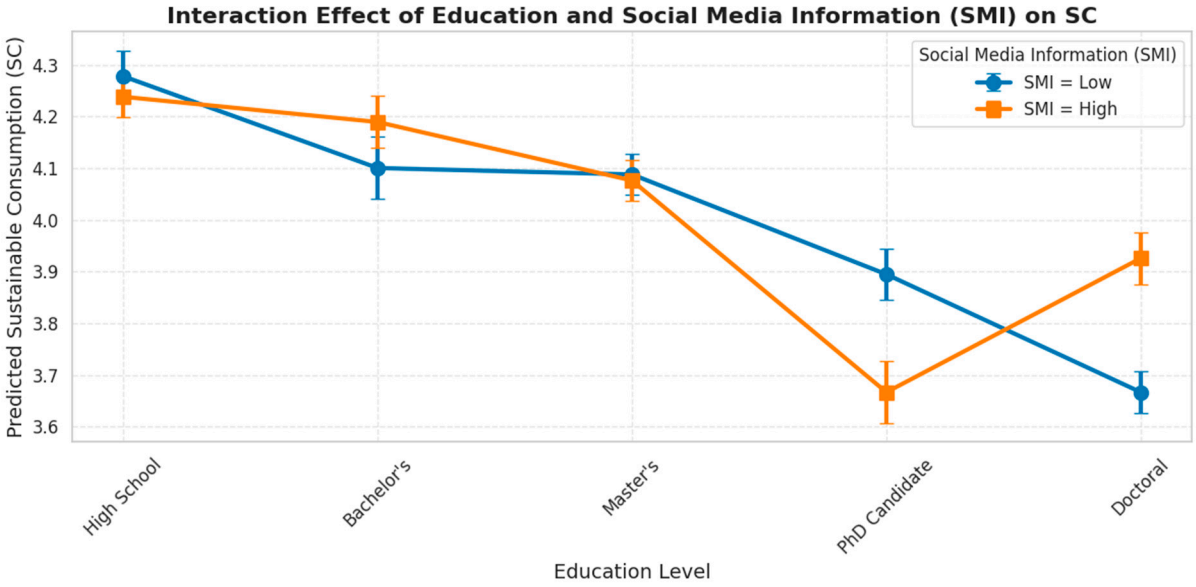

Figure 7. Interaction effect of education level and social media information (SMI) on predicted sustainable consumption (SC), with error bars indicating 95% CI.

4.4. Further Analysis with HEXACO Traits

Interaction Analysis Between HEXACO Traits and Emotional Predictors

The results have so far revealed that eco-guilt and eco-grief were significant predictors of CCI and SC. Investigating how those emotional predictors interact with HEXACO traits may show whether certain personality traits are more responsive to feelings of guilt or grief. To this end, we investigate the interaction effects of HEXACO personality traits and emotional predictors on CCI and SC using GLMs.

The model, with a R^2 of 0.2713, accounted for 27.13% of the variance in CCI. The significant main effects and interactions included EGQ having a significant positive association with CCI (b = 1.308, SE = 0.280, z = 4.673, $p < 0.001$, 95% CI [0.760, 1.857]), suggesting that greater eco-guilt is related to higher climate action intentions. Emotionality showed a significant positive main effect (b = 0.778, SE = 0.296, z = 2.630, $p = 0.009$, 95% CI [0.198, 1.357]), indicating that higher emotionality is associated with greater climate action intentions. There was a significant interaction between EGQ and emotionality (b = −0.198, SE = 0.076, z = −2.619, $p = 0.009$, 95% CI [−0.346, −0.050]), suggesting that the effect of eco-guilt on CCI is moderated by levels of emotionality, with higher emotionality potentially diminishing the positive association between EGQ and CCI. Moreover, EA showed a significant negative association with CCI (b = −0.263, SE = 0.133, z = −1.981, $p = 0.048$, 95% CI [−0.522, −0.003]), indicating that higher environmental awareness might relate to slightly lower climate action intentions in this context.

A similar GLM for sustainable consumption (SC) revealed a R^2 of 0.2965, explaining approximately 29.65% of the variance in SC. Significant results included that EGQ showed a significant positive effect on SC (b = 1.101, SE = 0.298, z = 3.700, $p < 0.001$, 95% CI [0.518,

1.684]), indicating that higher eco-guilt is associated with greater sustainable consumption intentions. Although the main effects of HEXACO traits such as emotionality and conscientiousness were observed, their interaction terms with emotional predictors did not reach statistical significance, suggesting that the direct impact of HEXACO traits on SC was limited in this model configuration (Table 8).

Table 8. Significant findings for HEXACO and emotional predictor interactions.

DV	Predictor	Coeff. (b)	SE	z-Value	*p*-Value	95% CI
CCI	EGQ	1.308	0.280	4.673	<0.001	[0.760, 1.857]
	Emotionality	0.778	0.296	2.630	0.009	[0.198, 1.357]
	EGQ × Emotionality	−0.198	0.076	−2.619	0.009	[−0.346, −0.050]
	EA	−0.263	0.133	−1.981	0.048	[−0.522, −0.003]
SC	EGQ	1.101	0.298	3.700	<0.001	[0.518, 1.684]

Interestingly, these findings emphasize the roles of eco-guilt and emotionality in shaping climate action and sustainable consumption behaviors, respectively, while eco-guilt is a strong driver of pro-environmental intention and behavior in both models. Further, emotionality moderates the relationship between eco-guilt and climate action intentions, providing insight into the nuanced emotional dynamics that may influence pro-environmental actions. Following the interaction analysis, it emerged that emotionality was a significant moderator of the relationship between eco-guilt and climate change intention as measured by CCI. That is, different levels of emotionality varied in the degree to which eco-guilt influenced intentions to engage in climate action. In order to visually capture this interaction, average CCI scores are plotted across a range of eco-guilt levels with shaded confidence intervals in Figure 8. As illustrated from the plot, CCI increased more strongly for low-emotionality individuals with rising eco-guilt levels, while for the individuals with high-emotionality, the association was more modest. The effect sizes suggest that the climate action intentions of people with low emotionality are more vulnerable to an increase in eco-guilt, while those high in emotionality report consistent intentions across different levels of eco-guilt.

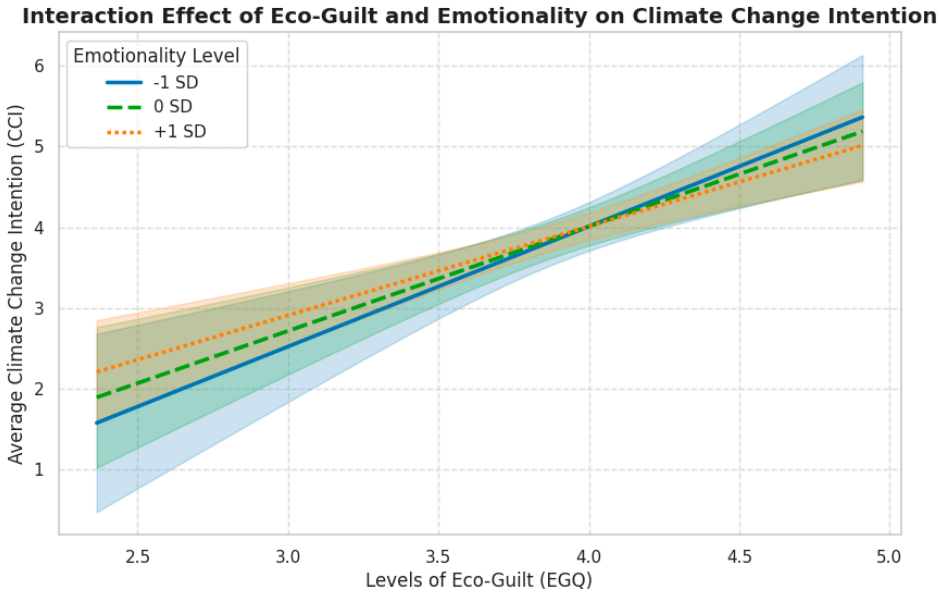

Figure 8. Interaction effects of EGQ on CCI at different levels of emotionality, at 95% CI.

4.5. Mediation Analysis

Mediation analysis was conducted using the PROCESS macro [100,101], with personal experience of climate change (PER) as the independent variable, and climate change worry

(CCW) and eco-guilt questionnaire (EGQ) as mediators for both climate change Intentions (CCI) and sustainable consumption (SC) as the dependent variables, while age and gender as were included as covariates. The selection of CCW and EGQ as mediators in this analysis is justified because both of these have been used to translate personal environmental experience into actionable intentions. CCW embraces more cognitive, risk-oriented concerns about climate change, while the EGQ reflects deeper emotional responses to environmental degradation. By controlling for these demographic variations, arguably influencing emotional and behavioral responses, including age and gender as covariates further increased the robustness of the findings. Again, this mediation analysis here supports, confirms, and extends our earlier models of hierarchy and interaction, which have emphasized the critical roles of demographic and emotional factors in shaping CCI and SC. For this reason, the analysis of pathways through which personal experience (PER) flows into both intentions and actions adds depth to the insights on underlying psychological mechanisms. Building on personal experience by incorporating both emotional and demographic influences within one framework therefore befits a well-rounded perspective on the drivers of pro-environmental behavior.

The regression analysis revealed a significant positive relationship between personal experience with climate change (PER) and climate change intentions (CCI), while controlling for age and gender ($\beta = 0.5533$, SE = 0.0349, t = 15.86, $p < 0.001$, 95% CI [0.4849, 0.6217]), with an explained variance of $R^2 = 0.44$ ($F(5, 598) = 93.51$, $p < 0.001$). This indicates that higher levels of personal experience with climate change are associated with stronger intentions to engage in climate action. Additionally, PER significantly predicted both mediators: CCW ($\beta = 0.0864$, SE = 0.0400, t = 2.16, $p = 0.031$, 95% CI [0.0080, 0.1648], $R^2 = 0.012$, $F(3, 600) = 2.49$, $p = 0.059$) and EGQ ($\beta = 0.2894$, SE = 0.0288, t = 10.06, $p < 0.001$, 95% CI [0.2330, 0.3458], $R^2 = 0.164$, $F(3, 600) = 39.14$, $p < 0.001$). These findings suggest that personal experience with climate change not only directly influences intentions to act, but also affects the emotional responses of worry and guilt related to climate change. When examining the influence of the mediators on CCI, both CCW and EGQ were significant predictors. CCW had a positive effect on CCI ($\beta = 0.0905$, SE = 0.0329, t = 2.75, $p = 0.006$, 95% CI [0.0260, 0.1550]), indicating that higher levels of climate change worry are associated with stronger climate action intentions. Similarly, EGQ was a strong predictor of CCI ($\beta = 0.3070$, SE = 0.0457, t = 6.71, $p < 0.001$, 95% CI [0.2173, 0.3966]), suggesting that eco-guilt also plays a significant role in motivating climate action intentions. The bootstrapping analysis for indirect effects revealed a significant indirect effect of PER on CCI through EGQ (Effect = 0.0888, Boot SE = 0.0190, 95% Boot CI [0.0558, 0.1296]), while the indirect effect through CCW was smaller but still significant (Effect = 0.0078, Boot SE = 0.0048, 95% Boot CI [0.0009, 0.0207]). These results support the hypothesis that CCW and EGQ mediate the relationship between personal experience with climate change and climate action intentions. Since the direct effect of PER on CCI remains significant, these results indicate partial mediation by both CCW and EGQ (Table 9).

Table 9. Summary of mediation analysis on CCI.

Path	Effect	Coeff. (β)	t-Value	*p*-Value	95% CI	Mediation Type
PER → CCW → CCI	Indirect Effect	0.0905	2.75	0.031	[0.0009, 0.0207]	Partial Mediation
PER → EGQ → CCI	Indirect Effect	0.3070	6.71	< 0.001	[0.0558, 0.1296]	Partial Mediation
PER → CCI	Direct Effect	0.5533	15.86	< 0.001	[0.4849, 0.6217]	—

In summary, PER positively influences CCI, both directly and indirectly through the emotional pathways of CCW and EGQ. The total explained variance for CCI was substantial ($R^2 = 0.44$), indicating that emotional responses significantly enhance the impact of personal experience on climate action intentions. An illustration of the parallel mediation is depicted in Figure 9.

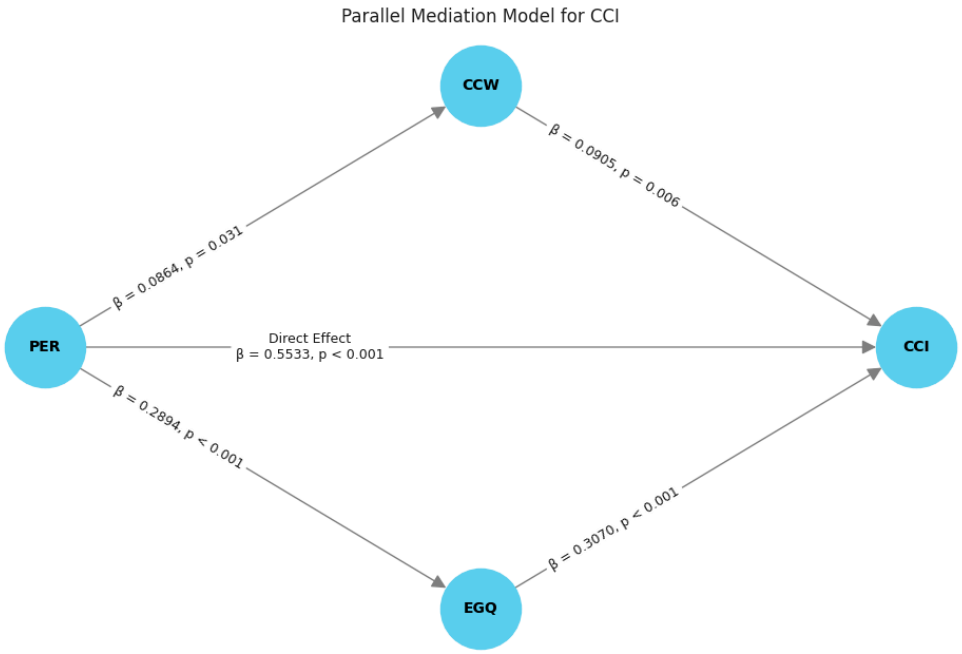

Figure 9. Visual illustration of the parallel mediation model examining the impact of personal experience with climate change (PER) on climate change intentions (CCI), mediated by climate change worry (CCW) and eco-guilt questionnaire (EGQ).

Additionally, for the dependent variable of sustainable consumption (SC), the regression analysis revealed a significant positive relationship between PER and SC while controlling for age and gender (β = 0.6376, SE = 0.0357, t = 17.84, $p < 0.001$, 95% CI [0.5675, 0.7076]), with an explained variance of R^2 = 0.49 (F(5, 598) = 116.17, $p < 0.001$). This indicates that higher levels of personal experience with climate change are associated with increased engagement in sustainable consumption behaviors. Moreover, PER significantly predicted both mediators: CCW (β = 0.0864, SE = 0.0400, t = 2.16, $p = 0.031$, 95% CI [0.0080, 0.1648], $R^2 = 0.012$, F(3, 600) = 2.49, $p = 0.059$) and EGQ (β = 0.2894, SE = 0.0288, t = 10.06, $p < 0.001$, 95% CI [0.2330, 0.3458], $R^2 = 0.164$, F(3, 600) = 39.14, $p < 0.001$). These findings suggest that personal experience with climate change influences emotional responses related to worry and guilt about climate change. In examining the mediators' influence on SC, EGQ was a significant predictor (β = 0.3478, SE = 0.0468, t = 7.43, $p < 0.001$, 95% CI [0.2561, 0.4396]), suggesting that eco-guilt plays a substantial role in motivating sustainable consumption. However, CCW did not significantly predict SC (β = 0.0370, SE = 0.0337, t = 1.10, $p = 0.272$, 95% CI [−0.0290, 0.1031]). The bootstrapping analysis for indirect effects showed a significant indirect effect of PER on SC through EGQ (Effect = 0.1007, Boot SE = 0.0183, 95% Boot CI [0.0690, 0.1415]), while the indirect effect through CCW was not significant (Effect = 0.0032, Boot SE = 0.0035, 95% Boot CI [−0.0010, 0.0136]). Since the direct effect of PER on SC remains significant, this suggests partial mediation through EGQ only (Table 10).

Table 10. Summary of mediation analysis on SC.

Path	Effect	Coeff. (β)	t-Value	*p*-Value	95% CI	Mediation Type
PER → CCW → SC	Indirect Effect	0.0370	1.10	0.272	[−0.0290, 0.1031]	No Mediation
PER → EGQ → SC	Indirect Effect	0.3478	7.43	< 0.001	[0.2561, 0.4396]	Partial Mediation
PER → SC	Direct Effect	0.6376	17.84	< 0.001	[0.5675, 0.7076]	—

To summarize, personal experience with climate change influences sustainable consumption directly and indirectly through eco-guilt. The variance explained for SC ($R^2 = 0.49$) indicates that emotional factors, in particular eco-guilt, partly mediate the

path between personal experience of climate change and sustainable consumption, while climate change worry does not contribute significantly to this mediation path (Figure 10).

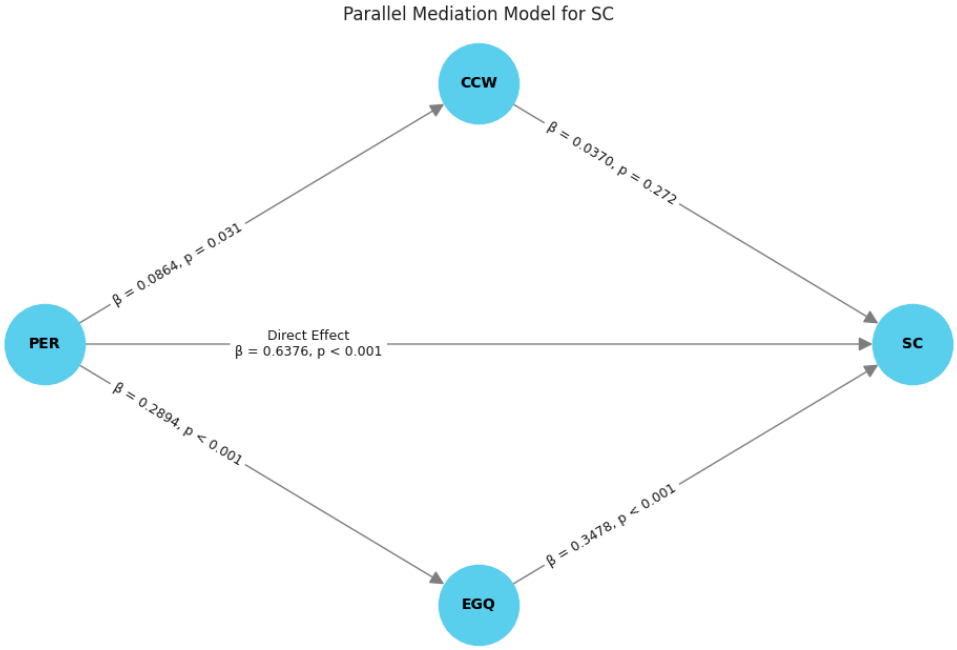

Figure 10. Visual illustration of the parallel mediation model evaluating the influence of personal experience with climate change (PER) on sustainable consumption (SC), mediated by climate change worry (CCW) and eco-guilt questionnaire (EGQ).

5. Discussion

5.1. Findings of Emotional Predictors of Climate Action

The current study investigated the interplay of influences on climate action intentions (CCI) and sustainable consumption (SC), considering complex emotional predictors, nature-related factors, personality traits, and demographic moderators. These results indicate and establish new pathways and an in-depth understanding of pro-environmental behavior and how individuals respond to emerging climate challenges. This study contributes to the literature by investigating how emotional responses, personality traits, and social media influence combine interactively to affect climate action and sustainable consumption. It also points out the possibility of meaningful interventions based on emotional and personality-based insights to foster sustainable behaviors and inform future policy and advocacy strategies in environmental engagement.

The study offers insights into emotional predictors, namely eco-guilt, eco-grief, and environmental empathy, which give shape to climate action intentions. As the prior literature has emphasized the role of eco-guilt as a motivator in behavior change, guilt and alike emotions have emerged in several discussions related to moral obligations and pro-environmental actions, according to Zeier and Wessa [36]. The association found between eco-guilt and intentions to act upon climate amplifies the view that guilt is a self-regulatory emotion; it impels people to make amends for perceived wrongdoing against the natural environment. Guilt, being fundamentally a moral emotion, may correlate with an increased likelihood of engagement to seek immediate actions in remedying their roles in environmental destruction at either personal or collective levels through lifestyle changes or green initiatives [20,26]. The relationship between eco-guilt and corrective actions suggests that guilt might be linked with prompt intentions toward pro-environmental behavior. However, the present study underlines a discrete pathway via eco-grief. Unlike guilt, which tends to be an altogether more immediate and corrective response, grief is often an emotional response characterized by sorrow and a deeper realization of loss. This response is grieving-based and is important in cementing the idea that climate change is indeed not

an environmental problem alone but one that is emotional and existential in nature: a crisis in which individuals are faced with mourning irretrievable losses of natural landscapes, biodiversity, and cultural connection to the environment. This paper hypothesizes that eco-grief, through the induction of longer-term emotional involvement, is more likely to contribute to a commitment to sustained climate action rather than an isolated behavior [18,21,40]. Whereas eco-guilt tends to be reparative but shorter-term in nature, it is possible that eco-grief may facilitate the integration of long-term environmental goals more meaningfully and elicit continued participation in climate activism, education, and the support of sustainable policy initiatives. Meanwhile, in the same manner, environmental empathy turned out as a strong predictor of climate action intentions, thereby supporting the finding [17,63,85] that empathy serves as the foundation for developing a personal connection with environmental issues. Empathy serves as a conduit for perspective-taking and invokes an understanding of shared vulnerability that can begin to close the gap between environmental awareness and active participation. In inviting individuals to contemplate climate issues more profoundly and build a personal relationship with environmental harm, empathy moves them to inspire actions outside of personal interests [17,57]. This study underlines how the notions of a personal relationship to environmental damage and related emotions can result in wider socially motivated responses that reinforce the notion of climate action as a communal affair.

5.2. Nature Connectedness and Climate Anxiety Findings

Nature connectedness and climate anxiety seem to be significant yet different drivers of pro-environmental behavior; their interaction is reflected in this research. In line with the literature on nature connectedness, the role that it has played regarding increasing an ecological sense of responsibility has been supported, in which people with a high level of connectedness with nature are more considerate of the natural environment [18]. This study confirms this again, where participants who reported high levels of nature connectedness also showed greater intentions for climate action and sustainable consumption. This relationship seems indicative that an individual's personal attachment to nature develops values and attitudes highly congruent with sustainable lifestyle behaviors. That could mean persons perceiving themselves as a part of the natural environment feel urged to better take care of it [17,57,59]. However, climate anxiety represents a more complex relationship to pro-environmental behavior. Whereas typically considered a psychological stressor and usually associated with feelings of helplessness or being overwhelmed, more recently climate anxiety has been framed in academic discourse as a potential driver of action, provided that it falls within levels considered manageable [25,26,36,75]. In this present research, a moderate level of climate anxiety, coupled with high nature connectedness, appears to act as a driver of pro-environmental behavior. This finding is in line with recent studies indicating that anxiety could be utilized as a motivating force if not debilitating, by increasing the urgency and personal accountability perceived by individuals toward climate issues [25,27,36]. In this respect, climate anxiety acts as a potent force for motivation, driving individuals to act with sustainability as they want to manage their environmental anxieties. This synergistic effect suggests that the development of an affirmative relation with nature, together with appropriate climate challenge awareness, may enable individuals to use anxiety as a driver of constructive actions and not as a crippling influence. The observed synergy between nature connectedness and climate anxiety suggests that both factors, when present together, may foster resilience and intentions aligned with environmental conservation [25,27,75].

5.3. Personality Traits Influences on SC and CCI

The HEXACO personality model offers a useful framework through which the drivers of pro-environmental and pro-social behavior could be investigated. This study underlines the issue of highlighting differential influences specific to certain traits. Emotionality, honesty-humility, and openness to experience proved to be strong predictors, per prior

research, of both climate action intentions and sustainable consumption behaviors. This is further corroborated by the relation of emotionality with emotions such as eco-guilt and eco-grief in relation to climate action intentions [68,69]. It would appear that this heightened sensitivity acts as a very strong motivator of pro-environmental intentions, as will be discussed here, showing that emotionality not only correlates with climate action, but also amplifies sustainable behaviors when interacting with eco-grief. This would further suggest that the sensitives are intrinsically more responsive to the emotional dimensions of climate challenges, hence positioning themselves to be leading agents or even advocates in climate initiatives [32,69]. Honesty-humility and openness to experience also facilitate pro-environmental behavior, but to varying extents. A high honesty-humility trait score was found to strongly relate to climate action, in support of previous studies which have associated the trait with goal-directed behavior, self-control, and responsibility for societal well-being. This finding suggests that conscientious individuals could act pro-environmentally out of a sense of duty, systematically fitting sustainable practices into daily life [34,69]. By contrast, openness to experience contributed to pro-environmental behavior in a more exploratory manner. Individuals high in openness evidenced sustainable engagement, which also supports results showing that openness enables curiosity and flexibility, which can lead to an openness toward trying new greener behaviors [34,72,73]. This differential power of HEXACO traits in the present study gives a deeper view into how personality dimensions might influence sustainability engagement [32,72,73]. Pro-environmental programs designed around these personality traits could enhance participation by appealing to emotional sensitivity in high emotionality individuals, structured goal-setting in the conscientious, and innovative approaches with those high in openness [32,34,68,72].

5.4. Demographic Moderators and Interaction Effects Consequences

Interactions with demographic variables such as gender, education, and influences of social media added significant insights into the variability of pro-environmental behavior. Gender differences in climate action intentions were similar to prior findings, as females had stronger intentions, especially in response to eco-guilt and eco-grief [26,35,36]. This is also in line with previous research that women are generally more concerned and empathetic toward the natural environment, probably as a result of socialization processes emphasizing nurturing and protective behaviors. With these predispositions, gendered social roles could, therefore, underpin how individuals emotionally engage with environmental issues and, consequently, their motivations toward climate change action. The findings suggest that individuals with higher education may be more responsive to climate-related information available on social media, which in turn may influence intentions for sustainable consumption [14,40,41]. Again, this agrees with studies showing that education often increases environmental awareness and critical engagement with digital content. This points to the very significant role of education in amplifying the effect of social media, besides underscoring that social media has the potential to empower people with the knowledge to interpret and act upon environmental information in complex or polarized media environments. Social media influence as a moderator supplies another layer of complication in the shaping of pro-environmental behavior [14,40,42]. Exposure to environmental issues through social media has been observed to raise awareness, especially among younger populations and with a higher level of education [37,49,74]. These findings suggest that social media can act as a bridge in the dissemination of environmental information to a larger area and also leverage the role of educational background in enhancing sustainable consumption intention. The results provide evidence of the potential role of social media as a tool in environmental advocacy, especially when tailored to reach demographic groups that are highly receptive to digital content. Through targeted and instructive content, social media platforms may nurture a sense of sustainability and informed engagement in pro-environmental behavior across demographic boundaries.

5.5. Mediation Analysis Results

The mediation analysis provides valuable information into how personal experiences with climate change (PER) explain intentions for climate action (CCI) and sustainable consumption (SC) through the emotional pathways of climate change worry (CCW) and eco-guilt (EGQ). CCW and EGQ both act as mediators for CCI. The above dual mediation underlines that the intentions to act on climate change are influenced not only by direct personal experiences but, importantly, by emotional responses that engage the cognitive and moral dimensions. The mediator of climate change worry taps into the cognitive and risk-oriented aspects of climate perception. Individuals with moderate CCW appear to be motivated, so that their concerns turn into actionable intentions, which also supports recent studies suggesting that manageable anxiety can facilitate rather than inhibit pro-environmental engagement. However, eco-guilt exerts a much stronger mediation effect, which may suggest that feelings of guilt over environmental degradation have more powerful motivational effects on intentions. This would be in line with those theoretical approaches that link guilt to personal responsibility and may thus motivate corrective action [20,26]. Partial mediation by both CCW and EGQ suggests that, although PER has a direct influence on CCI, such emotional responses strengthen this relationship by giving a more deep-seated motivational basis to climate intentions. For SC, the mediation results suggest that eco-guilt is a significant mediator, but climate change worry is not a meaningful mediator. This divergence might suggest that even though worry could build intentions, as a much weaker affective state, it is unlikely to drive extended behavioral manifestations such as sustainable consumption, which would require a more profound moral or affective commitment. This mediating role of eco-guilt suggests that guilty feelings about personal responsibility for environmental impact are a significant motivational factor in consumption choices aligned with sustainability. These results compliment previous studies by indicating the role of guilt in driving behavior intended to align with social norms and moral standards, especially when such behavior has to do with perceived harm or personal accountability [20,26,36,64,65]. These findings suggest that acknowledging emotional diversity may provide valuable insights into climate-related intentions, with interventions fostering manageable levels of worry along with personal responsibility being likely to realize powerful effects on fostering climate-positive behaviors across different levels of pro-environmental engagement.

To provide a more balanced perspective, it is important to acknowledge why some individuals or groups may not be able to prioritize climate awareness, as different economic, cultural, and social factors are strong modifiers of pro-environmental behavior [18,21,51]. These limitations due to economic resources would imply that members of lower socioeconomic groups may not be able to afford many options for eco-friendliness, or may have to prioritize basic survival needs over those related to sustainability [17,37,39]. However, cultural values and societal norms may make other communities place more emphasis on economic growth or traditional practices and play down environmental concerns. Divergent value systems that emphasize issues of job security or industrial development serve to drive responses to messages on climate action, along with unequal access to social media and educational resources. Limited access to climate-related information or even lack of engagement with digital content may reduce the effectiveness of environmental advocacy activities, particularly in sections of the general public who have limited access to the internet or lower levels of education [10,102,103]. Being sensitive to such diverse perspectives is one indicator of the richness of pro-environmental behavior and serves to underline that if climate advocacy efforts are to be effective, they need to consider the social-economic and cultural contexts of people's priorities for climate-related issues [23,42].

6. Practical and Theoretical Implications

The present research study contributes to the theoretical understanding of pro-environmental behavior by showcasing the complicated interactions among emotional predictors, nature connectedness, personality traits, and demographic factors in shaping climate action intentions and sustainable consumption [14,31,33,71]. Current theories in environmental psychology could be informatively broadened to take into consideration a greater variety of emotional experiences than previously thought, including eco-guilt, eco-grief, and environmental empathy, each of which uniquely contributes to climate engagement [36,39,61,64]. These additions enhance the understanding that emotional arousals are indeed not just by-products but motivating elements that can sustain the engagement of people over time. The practical implications of the results underline the value added by multi-dimensional climate advocacy strategies, which embed emotive, personal, and social dimensions. Policymakers and environmental organizations will be able to devise interventions that harness discrete emotions which correspond with climate action, deploying guilt to bring about an immediate response, and grief to prompt one's prolonged engagement. Personality-based approaches also invite possibilities for crafting messages and campaigns to speak with different personality profiles and, in so doing, have a greater effect. For instance, messages addressed to people who scored high in emotionality would focus on the emotional consequences of not taking action on climate issues, while messages aimed at people high in honesty-humility would be appropriately supported by themes of duty and responsibility. Of particular importance is demographic-sensitive messaging. Social media, if applied consistently with the identified educational background and gender-specific trends revealed from the study, can reduce information gaps among young and educated audiences or users. Such tailored approaches facilitate a wider engagement across diverse population segments, hence making climate advocacy more inclusive and effective. Interventions that can target emotional connections, consonance of personality traits, and demographic contexts will go on to create a more resilient and ecologically engaged population willing to provide solutions to the problems of climate change.

7. Conclusions, Limitations and Future Directions

Climate change is an irreversible process of planetary influence that threatens human livelihoods. It requires major and immediate social transformations to ensure that our life on the planet does not deteriorate further in the coming years. Continued efforts to raise awareness can help us to understand and make sense of the changes needed to produce sustainable models of socio-economic development that do not cost the earth, to protect human and environmental rights equally, and to activate citizens and to build coalitions for a bottom-up dynamic for the environment. In terms of social change, advocacy for the weak, justice and equality as core values, the establishment of objectives and action, and engaging modern and active citizens can be positive contributors to the problem of the climate crisis through the integration of environmental concerns into theory and practice and environmental literacy. An early understanding of present transformative dynamics can contribute to a more natural and sustainable world that can be passed on to future generations as a legacy of hope rather than destruction. This study highlights the subtle influence of emotional, social, and demographic factors, thereby forming intentions toward climate action and sustainable consumption. The findings present how eco-guilt, eco-grief, and environmental empathy interact with other influences, such as interconnectedness with nature and personality traits, to lead individuals toward climate-positive action. These insights on personal and collective drivers of climate-related intentions shed light on how multiple emotional and social influences can trigger attitude and behavior changes relevant to climate engagement. Thus, this work expands the knowledge of motivations that support climate-responsive behaviors, and offers context for future work meant to facilitate pro-environmental engagement across a wide range of social and demographic groups.

This research is not without limitations. First, the cross-sectional design poses limitations for interpreting causal relationships, as it captures data at a single point in time, providing a snapshot of associations without establishing the sequence or direction of influence [76,77]. The use of snowball sampling facilitated access to a broad range of participants and provided valuable preliminary insights into the associations between psychological traits and climate intentions. Future studies may consider complementary sampling methods to enhance the generalizability of findings across a wider population. Whereas our findings indicate strong associations between emotional predictors, nature-related factors, and climate-related intentions, the lack of consideration for possibly confounding variables, including socioeconomic status, political orientation, and geographic location, might introduce confounding effects. Future studies should consider using these as control variables to lend support for the causal inferences. This indicates the general problems inherently linked to the attempt to draw any kind of causational inference from a study in observational data regarding environmental behavior. It points to a need for further studies to be designed as longitudinal or even experimental in design. Longitudinal studies could extend insight and show how these relationships unfold over time [77,104]. Although this research took precautions and checked for common method bias in our sample, reliance strictly upon self-report measures probably predispositions the response accuracy, particularly on matters related to personal emotions and pro-environmental behaviors [88,89]. The current paper focused on a specific set of emotional predictors and HEXACO traits aligning with contemporary literature; further research surrounding dimensions of emotions, either positive or negative, and other personality constructs could extend the understanding of climate behaviors [35,42,65]. An expansion of research to diverse cultural contexts and social dynamics would, therefore, enhance the applicability of the findings in view of the fact that although environmental concerns are intrinsically global, experiences that come along with them may not necessarily be comparable across societies and settings [22,42,58,72]. Although composite scores were used to represent these multifaceted constructs, it is acknowledged that analyses of subscales may bring fuller insights into their various facets [16,27,54,75]. This approach is representative of the standard in studies of this nature and facilitates ease of interpretation; despite this, future studies could consider examining item-level responses to gain a more nuanced understanding of these constructs.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee (REC) of the University of Patras (application no. 14045, date of approval 26 August 2022). The committee reviewed the research protocol and concluded that it did not contravene the applicable legislation and complied with the standard acceptable rules of ethics in research and of research integrity as to the content and mode of conduct of this research.

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

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The author declares no conflicts of interest.

Appendix A

Table A1. Measurements used for data analysis.

Sustainable Consumption (SC)		
SC1	Climate change caused me to change my consumption habits to be more sustainable.	Severo, De Guimarães and Dellarmelin [16]
SC2	Climate change made me buy even more environmentally friendly products.	
SC3	Climate change caused me to reduce waste production through prevention, reuse, and recycling.	
Climate Action Intentions (CCI)		
CCI1	I plan to become involved in politics in the future to limit the consequences of climate change	Zeier and Wessa [36]
CCI2	I plan to become involved in activism in the future to limit the consequences of climate change	
CCI3	I plan to act in an environmentally protective way in my everyday life in the future to limit the consequences of climate change	
Personal Experience of Climate Change (PER)		
PER1	I have been directly affected by climate change.	Clayton and Karazsia [18]
PER2	I know someone who has been directly affected by climate change.	
PER3	I have noticed a change in a place that is important to me due to climate change.	
Eco-Guilt Questionnaire (EGQ)		
EGQ1	I very often feel that what I do for the environment is not enough, because it cannot balance other negative behaviors	Zeier and Wessa [36] and Ágoston, Urban, Nagy, Csaba, Kőváry, Kovacs, Varga, Dull, Monus and Shaw [21]
EGQ2	At times I feel some personal responsibility for the problems and unfolding impacts of climate change	
EGQ3	I blame myself for often behaving in an environmentally destructive way in situations where it could have been avoided	
EGQ4	I experience some guilt over the fact that my family and friends' lifestyles and consumption patterns are in part responsible for the unfolding impacts of climate change	
EGQ5	I often feel like a hypocrite when it comes to environmental action	
EGQ6	I feel guilty for not paying enough attention to the issue of climate change	
EGQ7	The more I know about the human causes of climate change, the more things I feel guilty about	
EGQ8	I am constantly angry with myself because I think that I am not doing enough and that I am harming the environment by my very existence	
EGQ9	It makes me feel uneasy that I am part of a system that is amplifying climate change	
EGQ10	I often blame myself for the fact that my needs and my work are not really important, but they contribute to the destruction of the environment	
EGQ11	I feel guilty when I do something polluting that I had stopped doing before	
Eco-Grief Questionnaire (ECOG)		
ECOG1	I feel some sense of loss because of climate change impacts that are becoming apparent in my local area.	Zeier and Wessa [36] and Ágoston, Urban, Nagy, Csaba, Kőváry, Kovacs, Varga, Dull, Monus and Shaw [21]
ECOG2	Watching videos of the destruction of the environment makes me cry.	
ECOG3	It makes me sad that I don't see many of the plants and animals I used to see often	
ECOG4	It is frightening that climate change is causing the destruction of natural areas at such a dramatic rate that they will never be the same again	
ECOG5	The wildlife around me has changed in a disturbing way	
ECOG6	I am not comforted by the thought that nature can regenerate itself to some extent, because what we have destroyed will never return	

Table A1. *Cont.*

Environmental Empathy (EE)		
EE1	I can perceive the pain suffered by the animals and plants.	Tam [85] and Zhou and Wang [86]
EE2	I can imagine the difficult situation of the animals and plants.	
EE3	I care and sympathize with the animals and plants.	
EE4	I visualize in my mind clearly and vividly how the suffering animals and plants feel in their situation.	
Connectedness to Nature Scale (CTN)		
CTN1	Right now I'm feeling a sense of oneness with the natural world around me.	Reese, Rueff and Wullenkord [27] and Mayer, Frantz, Bruehlman-Senecal and Dolliver [44]
CTN2	At the moment, I'm feeling that the natural world is a community to which I belong.	
CTN3	I presently recognize and appreciate the intelligence of other living organisms.	
CTN4	At the present moment, I don't feel connected to nature.	
CTN5	At the moment, I can imagine myself as part of the larger cyclical process of living.	
CTN6	At this moment, I'm feeling a kinship with animals and plants.	
CTN7	Right now, I feel as though I belong to the earth just as much as it belongs to me.	
CTN8	Right now, I am feeling deeply aware of how my actions affect the natural world.	
CTN9	Presently, I feel like I am part of the web of life.	
CTN10	Right now, I feel that all inhabitants of earth, human and nonhuman, share a common life force.	
CTN11	At the moment, I am feeling embedded within the broader natural world, like a tree in a forest.	
CTN12	When I think of humans' place on earth right now, I consider them to be the most valuable species in nature.	
CTN13	At this moment, I am feeling like I am only a part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.	
Environmental Awareness (EA)		
EA1	Climate change has made me increase the separation of organic and recyclable waste.	Severo, De Guimarães and Dellarmelin [16]
EA2	Climate change has caused me to reduce water consumption further, as this is a finite environmental resource.	
EA3	Climate change made me worry even more about the natural resources for future generations.	
EA4	Climate change made me realize about the reduction in air pollution.	
EA5	Climate change made me realize, even more, the environmental impact caused on the planet.	
EA6	Climate change has increased my environmental awareness.	
Climate Change Worry Scale (CCW)		
CCW1	I worry about climate change more than other people	Stewart [54]
CCW2	Thoughts about climate change cause me to have worries about what the future may hold	
CCW3	I tend to seek out information about climate change in the media (e.g., TV, newspapers, internet)	
CCW4	I tend to worry when I hear about climate change, even when the effects of climate change may be some time away	
CCW5	I worry that outbreaks of severe weather may be the result of a changing climate	
CCW6	I worry about climate change so much that I feel paralyzed in being able to do anything about it	
CCW7	I worry that I might not be able to cope with climate change.	
CCW8	I notice that I have been worrying about climate change.	
CCW9	Once I begin to worry about climate change, I find it difficult to stop.	
CCW10	I worry about how climate change may affect the people I care about.	

Table A1. *Cont.*

Social Media Marketing Information (SMI)		
SMI1	I learned from social media that green products are good for environmental protection.	Wu and Long [42]
SMI2	Using social media to search for information about green products is fashionable.	
SMI3	Through social media, I can share information about green products with my friends.	
SMI4	Social media advertising can provide me with timely and effective information about green products.	
SMI5	Through social media, I can interact with others to discuss information about green products.	
SMI6	It's easy to express my views on green products through social media.	
SMI7	Social media advertising is a good source of up-to-date product information	
SMI8	Social media advertising is a convenient source of product information.	
SMI9	The information about green products on social media is interesting.	

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