

Article

Highly Sensitive People and Nature: Identity, Eco-Anxiety, and Pro-Environmental Behaviors

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Abstract: High environmental sensitivity, known as sensory processing sensitivity, characterizes certain individuals, causing them to perceive and react intensely to external stimuli. Individuals with sensory processing sensitivity, referred to as highly sensitive people (HSPs), exhibit heightened emotional reactivity and empathy, alongside a profound aesthetic sensitivity and a unique connection to nature. This trait can lead to both advantages and challenges, including increased vulnerability to sensory overload. This correlation study explored the hypothesis that highly sensitive people could be more sensitive to natural stimuli, leading to a stronger environmental identity, a higher level of eco-anxiety, and more pronounced pro-environmental attitudes and behaviors. Data collection involved 501 Italian citizens (65.1% women; M age = 27.69 years; SD = 10.54). This study found positive correlations (between 0.20 and 0.47) between high sensitivity and environmental attitudes (e.g., New Ecological Paradigm and Climate Change Attitude Survey dimensions), identity aspects (e.g., connectedness to nature), behavioral aspects (e.g., pro-environmental behaviors), and eco-anxiety, suggesting that the highly sensitive person trait might be related to a stronger environmental identity, higher levels of eco-anxiety, and more pronounced pro-environmental attitudes and behaviors. However, some exceptions were identified: ease of excitation and low sensory threshold were not significantly correlated with conservation behaviors and environmental citizenship, while aesthetic sensitivity was consistently associated with pro-environmental behaviors (PEBs). Additionally, the low sensory threshold dimension appears to have a low association with attitudinal aspects measured by the Climate Change Attitude Survey. This suggests the complexity of sensory processing sensitivity and its nuanced impact on environmental dynamics. The findings emphasize the need for future research to explore the implicit dimensions of environmental attitudes and the emotional responses of HSPs to climate change. Practical recommendations include tailoring environmental education and policy strategies to address the unique emotional sensitivities of HSPs, fostering stronger engagement in pro-environmental actions.

Keywords: sensitivity; nature; eco-anxiety; identity; behavior



Academic Editor: Paulo Santos

Received: 31 January 2025

Revised: 14 March 2025

Accepted: 18 March 2025

Published: 19 March 2025

Citation: Duradoni, M.; Fiorenza, M.; Bellotti, M.; Severino, F.P.; Valdrighi, G.; Guazzini, A. Highly Sensitive People and Nature: Identity, Eco-Anxiety, and Pro-Environmental Behaviors. *Sustainability* **2025**, *17*, 2740. <https://doi.org/10.3390/su17062740>

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1. Introduction

The primary characteristic that distinguishes most living organisms is their capacity to perceive, process, and react to stimuli from the external environment [1]. This sensitivity to the environment is essential for effectively adapting to surrounding conditions; however, individuals exhibit variability in their sensitivity levels, with some being more sensitive

than others [2]. The notion of highly sensitive person (HSP) has been a subject of discussion in the academic literature for several years. Aron and Aron [3] were the first researchers to explore this concept, introducing the idea of sensory processing sensitivity. Faced with new stimuli, individuals employ two distinct strategies: either approaching and exploring, or exercising cautious attention that may lead to avoidance. According to Aron and Aron [3], the choice of strategy is linked to how sensory information is transmitted and processed in the brain, a concept they call sensory processing sensitivity (SPS). In the literature, SPS has been one of the theories (alongside differential susceptibility [4] and biological sensitivity to context [5]) proposed to explain environmental sensitivity [2]. Differently from the others, the sensory processing sensitivity (SPS) theory suggests that variations in environmental susceptibility arise from a personality trait linked to heightened information processing, increased emotional reactivity and empathy, greater awareness of environmental subtleties, and ease of overstimulation [6,7].

Individuals with higher environmental sensitivity (i.e., deeper perception and processing of stimuli; [3]), demonstrate a greater ability to discern details of their surrounding environment and are more strongly influenced by external events. They may exhibit heightened sensitivity to both the benefits and risks of a given environment [2]. Aron and Aron [3] propose that individual variations in SPS are partially determined by the reactivity of the Behavioral Inhibition System (BIS). BIS, alongside Fight/Flight and the Behavioral Activation System (BAS), constitutes one of the three hypothesized brain systems that regulate emotional behavior and form the neurological basis of temperament [8]. While SPS shares conceptual similarities with constructs such as behavioral inhibition [9], introversion [10], or shyness [11], it remains distinct from these traits. Specifically, research has demonstrated that SPS is recognized as a temperament trait rather than a disorder, yet its interaction with adverse environments can heighten vulnerability to maladaptive outcomes, including mental and physical health issues [3,12]. Moreover, highly sensitive individuals may be particularly vulnerable to adverse parental environments, with findings suggesting that SPS represents a temperamental trait that interacts significantly with environmental factors [13]. However, in the context of adverse childhood environments, individuals with high SPS levels may experience developmental trajectories that deviate from the norm, leading to negative consequences for well-being and an increased risk of behavioral issues and psychopathology in both childhood and adulthood [6,13,14]. Conversely, when exposed to positive life experiences, highly sensitive individuals have the potential to thrive, exhibiting enhanced emotional well-being and greater responsiveness to interventions [15–17]. This dual sensitivity underscores the role of environmental influences in shaping developmental outcomes for individuals with high SPS [12].

Initially, Aron and Aron [3] conceptualized SPS as a one-dimensional construct consisting of consistently correlated sensitivities, which appear heterogeneous, encompassing responses to intense sensory inputs, caffeine, hunger, pain, and others' moods. Further studies revealed three dimensions: ease of excitation (EOE), which refers to a heightened susceptibility to feeling overwhelmed by both external and internal stimuli, such as reacting negatively to multitasking or experiencing impaired performance when being observed; aesthetic sensitivity (AES), characterized by a deep appreciation for aesthetic experiences, including strong emotional responses to art and music; and low sensory threshold (LST), which reflects heightened sensitivity to sensory stimuli, leading to discomfort in response to bright lights, loud noises, or other intense environmental inputs. [7,18].

1.1. Trait Characteristics Associated with Nature

Research suggests that about 30% of the population exhibits a heightened sensitivity to their environment, which is linked to increased responsiveness—whether positive or

negative—to their surroundings [19]. Despite the potential advantages of natural environments for individuals with this trait, there has been limited investigation into its correlation with sensitivity to nature [20].

Nonetheless, a number of peculiar characteristics of highly sensitive people (HSPs) described by Aron and Aron [3] can be taken into consideration in order to explain this higher tendency they have to gain from nature. In particular, HSPs are more responsive to emotional and physical stimuli and have a deeper capacity to process environmental stimuli. This capacity has been linked to a stronger response to positive environments [15,17] and nature can be seen as one of them [21]. HSPs often experience sensory overload in stimulating or chaotic environments. Natural settings, characterized by their tranquility and harmony, could provide them a respite from the overstimulation of modern life [22].

An HSP also tends to be more empathic. This compassionate disposition extends to the natural world, as sensitive individuals often empathize with endangered species, and future generations affected by environmental degradation [20]. Nature may elicit profound emotional responses in sensitive individuals like HSPs who are characterized by a stronger emotional reactivity [23]. HSPs are characterized by aesthetic sensitivity and potentially possess a profound appreciation for the beauty and fragility of the natural world [6]. Therefore, it is possible to hypothesize that these two modalities could provide highly sensitive people (HSPs) with a multitude of advantages from the natural environment.

Indeed, numerous studies have demonstrated how positive environments bring greater benefits to HSPs, thus laying the groundwork for better understanding and predicting the effectiveness of certain interventions based on this temperament as an endogenous factor [24]. Although most of the research in this field has concentrated on developmental psychology, taking into account mostly the family and school contexts [16], it would seem that there is still more to learn about the connection between this personality trait and nature. The latest research explored the hypothesis of heightened sensitivity to natural stimuli among HSPs, and preliminary findings seem to support it. In a recent study, exposure to a nature video elicited a greater increase in positive affect in HSPs compared to low sensitive people, while no significant difference was observed in the reduction in rumination and negative affect [25]. Even though the results seem encouraging, further investigation is needed to really understand the complexity of this phenomenon. These explanations would find confirmation in a study demonstrating a significant positive correlation between SPS, connectedness to nature (CTN), and affinity with animals [20]. This could also suggest that HSPs are more predisposed to engage in pro-environmental behaviors (PEBs), coupled with the fact that they are driven by intrinsic values that may promote such behaviors [3,26]. This has been confirmed by a pilot study, which found that individuals exhibiting the trait of SPS report a greater number of PEBs compared to others, and furthermore, they appear to benefit more from interventions promoting PEBs [27].

1.2. Aim of the Study and Hypothesis Development

The aim of the present study is to examine the relationship between the HSP trait and environmental identity, focusing on how this trait influences pro-environmental attitudes, behaviors, and susceptibility to eco-anxiety (Figure 1). Specifically, this research seeks to understand whether heightened sensitivity is associated with a stronger identification with nature, greater engagement in environmentally responsible actions, and increased vulnerability to distress related to environmental concerns.

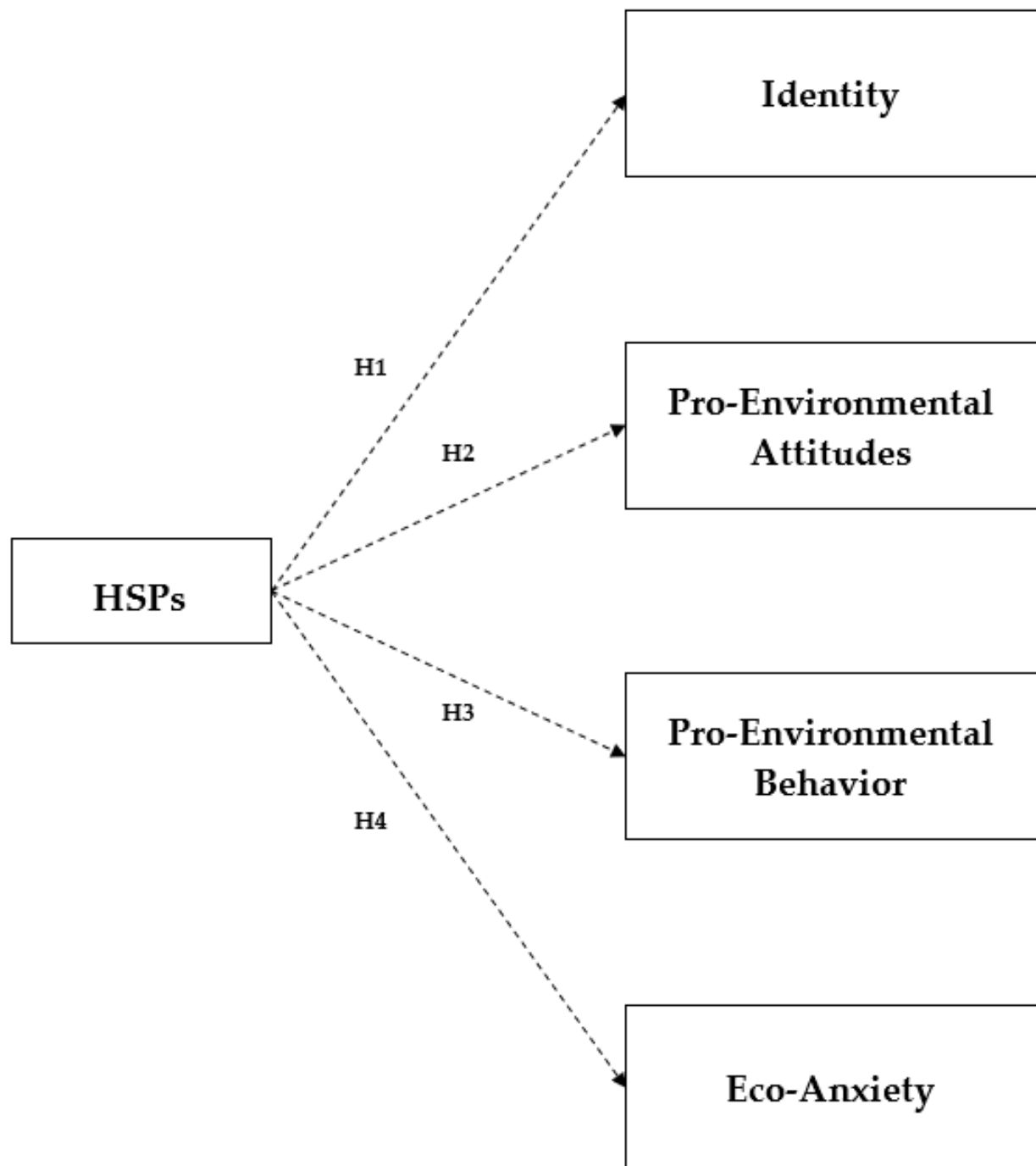


Figure 1. Illustration of the main hypothesized relationships between eco-anxiety, identity, pro-environmental attitudes, pro-environmental behaviors, and HSPs. Specifically, the model proposes that highly sensitive people (HSPs) tend to develop a stronger environmental identity (H1), exhibit more positive attitudes toward nature (H2), and engage in higher levels of pro-environmental behaviors (H3). Additionally, due to their heightened emotional reactivity, HSPs are more likely to experience elevated levels of eco-anxiety (H4). These interconnections highlight the complex role of sensitivity in shaping individuals' responses to environmental issues.

For HSPs, their heightened sensory sensitivity means that natural environments often provide a unique source of emotional and psychological well-being, offering restorative experiences and a sense of tranquility [3]. Because of these benefits, the development of a stronger environmental identity among HSPs can be hypothesized using the framework of the extended self theory, which posits that individuals incorporate external elements

that contribute to their well-being into their sense of self [28]. According to this theory, objects, places, and relationships that elicit positive emotions and fulfill psychological needs become integrated into one's self-concept, expanding their identity to include these external elements. In this case, the calming and enriching effects of nature may become intertwined with the self-concept of HSPs, leading to an extended self that includes the natural world. In particular, individuals high in aesthetic sensitivity are likely to develop a strong environmental identity due to their profound connection with nature's beauty [6,29]. When individuals with higher levels of low sensory threshold are immersed in nature, they exhibit a profound emotional response to its beauty, often experiencing a sense of awe. This heightened sensitivity shifts their focus away from the self and toward their natural surroundings, fostering a deeper sense of connection with the natural world [27,30].

For this reason, the following could be hypothesized:

H1: *Highly sensitive people tend to develop a strong environmental identity.*

H1a: *Individuals with higher levels of ease of excitation are more likely to have a stronger environmental identity.*

H1b: *Individuals with higher levels of aesthetic sensitivity are more likely to have a stronger environmental identity.*

H1c: *Individuals with higher levels of low sensory threshold are more likely to have a stronger environmental identity.*

The Theory of Reasoned Action (TRA; [31]) and the concept of HSP can be integrated by considering that this theory suggests that positive attitudes toward a particular object or experience stem from individual beliefs about the expected benefits, contributing to the formation of behavioral intentions consistent with those attitudes. In the case of HSPs, their tendency to have an intensified emotional and sensory response to environmental stimuli can be seen as a key factor in the process described by the TRA. Due to their predisposition to deeply process stimuli, HSPs are particularly inclined to develop an emotional connection with nature, as it provides a context that fulfills some of their fundamental psychological needs, such as the need for emotional self-regulation and reconnection with oneself. Additionally, the extended self theory [28] provides further insight into this phenomenon. Given the defining characteristics of HSPs, namely, ease of excitation, aesthetic sensitivity, and low sensory threshold, they may be particularly prone to internalizing nature as part of their self-identity, as suggested in H1. Their deep emotional engagement with the environment may lead them to perceive environmental threats as personal threats, as damage to nature could be experienced as an extension of harm to the self. This could lead them to have more positive attitudes towards nature and more environmental concern. In light of this, the following are hypothesized:

H2: *Highly sensitive people tend to develop more positive attitudes toward nature.*

H2a: *Individuals with higher levels of ease of excitation are more likely to have more positive attitudes toward nature.*

H2b: *Individuals with higher levels of aesthetic sensitivity are more likely to have more positive attitudes toward nature.*

H2c: *Individuals with higher levels of low sensory threshold are more likely to have more positive attitudes toward nature.*

Pro-environmental behaviors (PEBs) can be categorized into distinct clusters representing various domains of action. These clusters encompass different areas where such behaviors manifest [32]. The extent to which psychological and physical connections with nature can promote conservation behaviors has been examined [33], although these behaviors account for only a portion of PEBs. Additionally, research on the construct of connectedness to nature (CTN; [34]) has generated substantial empirical evidence, not solely limited to conservation behaviors. According to Mayer and Frantz [34], individuals with a strong connection to nature are less likely to engage in environmentally harmful behaviors, as they perceive nature as an integral part of their self-identity. Consequently, actions that harm the environment are also perceived as self-harm. Similarly, Schultz [35] argues that the value individuals attribute to an object depends on the degree to which they incorporate it into their self-concept. Thus, for the extended self theory [28], the stronger an individual's connection to nature, the more likely they are to engage in pro-environmental behaviors. Furthermore, if H2 is true, meaning that heightened sensitivity fosters stronger pro-environmental attitudes, then, according to the TRA [31], individuals with such attitudes are more likely to engage in PEBs. TRA suggests that attitudes shape behavioral intentions, which drive actions. Thus, if highly sensitive individuals develop positive attitudes toward nature, this would strengthen their self-identification with it and increase the likelihood of translating these attitudes into pro-environmental behaviors. Therefore, we expected the following:

H3: *Highly sensitive people tend to exhibit more PEBs.*

H3a: *Individuals with higher levels of ease of excitation are more likely to exhibit PEBs.*

H3b: *Individuals with higher levels of aesthetic sensitivity are more likely to exhibit PEBs.*

H3c: *Individuals with higher levels of low sensory threshold are more likely to exhibit PEBs.*

Highly sensitive people (HSPs) are characterized by heightened emotional reactivity and a greater awareness of environmental stimuli, which makes them more prone to experiencing intense emotions in response to external changes [3]. When applied to environmental issues, this heightened emotional response may increase susceptibility to eco-anxiety, defined as chronic fear and worry over ecological changes and environmental degradation [36]. Moreover, because HSPs often form deep emotional bonds with nature, their greater concern for environmental well-being may amplify feelings of distress when faced with ecological threats [37]. In particular, sensitivity to environmental aesthetics may also lead to eco-anxiety when they perceive threats to natural beauty, further motivating protective actions [27]. For this reason, the following could be hypothesized:

H4: *Highly sensitive people tend to experience heightened levels of eco-anxiety.*

H4a: *Individuals with higher levels of ease of excitation are more likely to experience heightened levels of eco-anxiety.*

H4b: *Individuals with higher levels of aesthetic sensitivity are more likely to experience heightened levels of eco-anxiety.*

H4c: *Individuals with higher levels of low sensory threshold are more likely to experience heightened levels of eco-anxiety.*

2. Methods

2.1. Participants and Design

Prior to participant recruitment, a power analysis was conducted to determine the required sample size for the purposes of the study and the planned analyses. Given the correlational nature of the research, the analysis aimed to identify the sample size necessary to detect effects accounting for as little as 1.5% of the variance (i.e., $r = 0.12$), with a statistical power of 0.80 and a significance level set at 0.05. Based on this analysis, it was determined that a sample of 428 participants would be sufficient to meet these criteria, ensuring adequate sensitivity to capture the hypothesized relationships while minimizing the risk of Type II errors.

The participants of this study were gathered through an anonymous census online. Although recruiting the sample through social networks poses a risk of bias, on polarizing topics (such as pro-environmental behaviors), being anonymous promotes more sincere responses [38].

The survey was promoted through online posts on popular social networking sites, primarily Facebook and Instagram, and was created using the Google Forms platform, in accordance with the privacy laws of Italy (Law Decree DL-101/2018) and EU regulations (2016/679). The study sample consisted of 501 Italian citizens, (65.1% cisgender women and 31.5% cisgender men), with an average age of 27.69 years and a range from 14 to 77 years (standard deviation of 10.54 years). Most of the sample had a high school diploma (46.7%) and a bachelor's degree (36.1%). In addition, more than half (55.3%) had an annual income of less than 10,000 euros.

2.2. Materials

A series of validated psychological scales were used to assess the relationships between high sensitivity, environmental identity, ecological anxiety, and pro-environmental behaviors. These instruments were selected based on their reliability and widespread use in previous research on environmental attitudes and personality traits. Below is a description of the measures used for data collection, and the characteristics of the various scales can be found in Appendix A.

Connectedness to Nature (CTN) scale [34]: This scale assesses the subject's affective and experiential connection with nature. There are 14 items on the scale with responses on a 5-point Likert scale. Responses range from 1 ("Strongly disagree") to 5 ("Strongly agree"). An example of an item included in the scale is the following: "I often feel a sense of oneness with the natural world around me". The scale proved to have a very good reliability index (Cronbach's $\alpha = 0.84$).

Climate Change Attitude Survey (CCAS) [39]: This scale consists of 15 items answered on a 5-point Likert scale ranging from 1 ("Strongly disagree") to 5 ("Strongly agree"). The scale, characterized by two dimensions, namely, beliefs (i.e., "I believe our climate is changing") and intentions (i.e., "Knowing about environmental problems and issues is important to me"), aims to assess people's beliefs and intentions towards the environment. The instrument reported a good reliability index (Cronbach's α for beliefs = 0.90; Cronbach's α for intentions = 0.78).

New Ecological Paradigm (NEP) [40]: This scale was used to measure environmental awareness and perception, especially in the context of ecological sustainability [41]. The scale consists of 15 items that capture 5 dimensions: reality of limits to growth (e.g., "We are approaching the limit of the number of people the Earth can support"), antianthropocentrism (e.g., "Humans have the right to modify the natural environment to suit their needs"), nature's balance fragility (e.g., "When humans interfere with nature, it often produces disastrous consequences"), rejection of human exceptionalism (e.g., "Human intelligence

will ensure that we do not make the Earth unlivable”), and possibility of an eco-crisis (e.g., “Humans are severely abusing the environment”). The scale uses a six-point Likert ranging from 1 = “Strongly agree” to 6 = “Strongly disagree”. Cronbach’s alpha for the entire 15-item scale was 0.83.

Highly Sensitive Person Scale (HSPS) [3]: The scale consists of 27 items assessing the sensitivity trait on a 7-point Likert scale (from 1 = “Not at all” to 7 = “Completely”). Initially the scale deemed to capture a single sensitivity factor, but after a subsequent exploratory and confirmatory factor analysis, approaches converge towards separate components [18], including (1) ease of excitation (EOE, namely, being easily overwhelmed by internal and external stimuli), (2) aesthetic sensitivity (AES, i.e., openness for, and pleasure of, aesthetic experiences and positive stimuli), and (3) low sensory threshold (LST, capturing sensitivity to external stimuli as bright lights or loud noises). Further psychometric validation of the HSPS conducted on a large sample ($N = 851$) confirmed this three-factor model, demonstrating good internal consistency (Cronbach’s α : EOE = 0.81; AES = 0.72; LST = 0.78) and strong construct validity [18]. Additionally, intercorrelations among the subscales suggest that while they capture distinct aspects of sensory processing sensitivity (SPS), they collectively contribute to an overarching sensitivity trait (EOE–AES: $r = 0.40$; EOE–LST: $r = 0.73$; AES–LST: $r = 0.45$). Cronbach’s alpha for the entire 27-item scale was 0.89 [18].

Pro-Environmental Behavior Scale (PEBS) [42]: The scale consists of 19 items with different response modes. Items 1 to 6 have a response mode ranging from 1 (“Never”) to 5 (“Always”). Item 7 has a response mode ranging from 1 (“Very High”) to 3 (“Low”). Items 8, 9, and 12 are dichotomous: 1 (“Yes”) or 5 (“No”). Items 10 and 11 range from 1 (“Never”) to 5 (“Constantly”). Item 13 has a 5-point Likert scale response mode ranging from 1 (“24 or less”) to 5 (“40 or more”). Items 14–16 are dichotomous: 1 (“No”) or 5 (“Yes”). Items 17–19 have a 3-point Likert scale with responses ranging from 1 (“Never”) to 5 (“Frequently”). The instrument consists of four dimensions, namely, conservation, environmental citizenship, food, and transportation. The scale reported a good reliability index (Cronbach’s $\alpha = 0.76$).

Hogg Eco-Anxiety Scale (EA) [43]: This scale measures individuals’ levels of anxiety related to environmental concerns and climate change. It consists of 13 items assessing the sensitivity trait on a 4-point Likert scale (from 0 = “Not at all” to 3 = “Nearly every day”). The scale consists of four dimensions, namely, (1) affective symptoms (emotional responses such as fear, worry, and sadness about environmental issues, e.g., “I feel anxious when I think about the future of our planet”); (2) rumination (repetitive and persistent thinking about climate change and its consequences, e.g., “I often find myself dwelling on the potential consequences of climate change”); (3) behavioral symptoms (actions or tendencies, like avoidance or hypervigilance, due to environmental concerns, e.g., “I avoid watching news about environmental issues because it makes me too upset”); and (4) personal impact (worries and catastrophic thoughts focused on the future impact of environmental crises, e.g., “I fear that environmental problems will lead to a catastrophic future for humanity”). Cronbach’s alpha for the entire 13-item scale was 0.93.

3. Results

Firstly, we calculated the descriptive statistics for the collected variables. Table 1 provides the range of scores, mean, standard deviation, and the values for skewness and kurtosis for the quantitative measures. These latter two indices, in particular, allowed us to evaluate deviations of the scores from a normal distribution, which is one of the assumptions that must be met to proceed with inferential parametric analyses.

Table 1. Descriptive statistics of HSP, CTN, NEP, CCAS, PEB, and EA dimensions.

Variable	Min	Max	Mean (S.D.)	Skew.	Kurt.
CTN	34	67	50.88 (6.28)	−0.123	−0.401
CCAS—Belief	14	45	40.82 (4.88)	−2.18	6.06
CCAS—Intention	10	30	25.09 (4.01)	−0.984	0.859
NEP	31	75	57.67 (7.5)	−0.364	−0.197
HSPS—Ease of Excitation	14	59	40.31 (8.067)	−0.211	−0.302
HSPS—Aesthetic Sensitivity	14	35	25.40 (4.21)	−0.280	−0.282
HSPS—Low Sensory Threshold	6	29	16.53 (5.03)	0.047	−0.668
HSPS—Total Score	47	132	88.37 (15.93)	−0.045	−0.432
PEBS—Conservation	16	35	27.91 (3.60)	−0.57	0.33
PEBS—Environmental Citizenship	6	26	13.42 (3.90)	0.446	0.212
PEBS—Food	3	15	10.19 (4.90)	−0.434	−1.422
EA—Affective Symptoms	0	12	4.45 (2.75)	0.323	−0.172
EA—Rumination	0	9	2.79 (1.89)	−0.264	−0.277
EA—Behavioral Symptoms	0	9	2.54 (2.24)	0.653	−240
EA—Personal Impact	0	0	3.00 (2.11)	0.420	−0.171

Note: HSPS = Highly Sensitive Person Scale; CTN = Connectedness to Nature scale; NEP = New Ecological Paradigm; CCAS = Climate Change Attitude Survey; PEBS = Pro-Environmental Behavior Scale; EA = Eco-Anxiety scale; Kurt. = kurtosis; S.D. = standard deviation; Skew. = skewness.

As evident from the table, nearly all variables appear to be normally distributed, with the exceptions of the belief dimension of CCAS and the food dimension of pro-environmental behaviors. Consequently, for the analyses concerning these two measures, we employed non-parametric statistics (Spearman's Rho).

To test our hypotheses, we calculated the correlations between high sensitivity scores and the variables related to various psychological and behavioral aspects of sustainability considered in our study. As observed, high sensitivity scores generally exhibit positive and statistically significant relationships with environmental attitudes (i.e., NEP and CCAS dimensions), identity aspects (i.e., CTN), behavioral aspects (i.e., PEBs), and eco-anxiety, confirming all the main hypotheses of this study (H1, H2, H3, and H4).

More specifically, Table 2 illustrates that these relationships typically range from moderate to relatively large magnitudes according to effect size interpretation guidelines in the social sciences [44].

When analyzing the components of high sensitivity, some exceptions to this general trend emerged. For instance, regarding PEBs, the ease of excitation and low sensory threshold dimensions appeared to play a marginal or negligible role in relation to conservation behaviors and environmental citizenship, while they are positively associated with food- and transport-related behaviors. These findings do not fully support hypotheses H3a and H3c. Additionally, the aesthetic sensitivity dimension stands out as the most consistently associated with all PEBs considered in our data collection, confirming H3b. Finally, the low sensory threshold dimension seems to have little to no association with the attitudinal aspects measured by CCAS, indicating that hypothesis H2c cannot be confirmed.

Table 2. Correlational matrix between HSPs, CTN, NEP, CCAS, PEB, EA, and their respective dimensions.

Variable	CTN	NEP	CCAS— Belief	CCAS— Intention	PEBS— Conservation	PEBS— Environmental Citizenship	PEBS— Food	PEBS— Transportation	EA—Affective Symptoms	EA— Rumination	EA— Behavioral Symptoms	EA—Personal Impact
HSPS—Ease of Excitation	0.175 **	0.201 **	0.292 **	0.219 **	0.110 **	0.046	0.212 **	0.228 **	0.453 **	0.277 **	0.320 **	0.326 **
HSPS—Aesthetic Sensitivity	0.472 **	0.300 **	0.293 **	0.325 **	0.303 **	0.324 **	0.282 **	0.249 **	0.254 **	0.236 **	0.201 **	0.396 **
HSPS—Low Sensory Threshold	0.240 **	0.104 *	0.093 *	0.040	0.141 **	0.110 *	0.259 **	0.136 **	0.378 **	0.218 **	0.344 **	0.295 **
HSPS	0.319 **	0.240 **	0.279 **	0.225 **	0.202 **	0.168 **	0.296 **	0.246 **	0.462 **	0.333 **	0.365 **	0.407 **
Total score												

Note: * = $p < 0.05$; ** = $p < 0.01$; HSPS = Highly Sensitive Person Scale; CTN = Connectedness to Nature scale; NEP = New Ecological Paradigm; CCAS = Climate Change Attitude Survey; PEBS = Pro-Environmental Behavior Scale; EA = Eco-Anxiety scale. When the analysis involved variables that were not normally distributed (i.e., belief and food), we employed Spearman’s Rho as a non-parametric alternative to Pearson’s correlation.

4. Discussion

High sensitivity, conceptualized as sensory processing sensitivity (SPS), is a personality trait characterized by heightened sensitivity to both internal and external stimuli, which involves a deep cognitive processing of sensory information [3,6]. This trait has garnered increasing attention in psychology, particularly in relation to individuals' interactions with the natural environment [2]. Specifically, it has been observed that individuals with high sensitivity tend to react more intensely to natural stimuli [45]. Moreover, these individuals often find nature to be an ideal environment for emotional recovery and stress reduction [46]. Highly sensitive people frequently describe a particularly deep connection with nature [22].

Consistently with all our main hypotheses (i.e., H1, H2, H3, and H4), the results demonstrated a general trend of positive correlation between SPS and various environmental variables, including CTN, NEP, CCAS, PEBs, and EA. These findings align with the existing literature and lend support to the theoretical hypothesis that individuals with high sensitivity exhibit increased responsiveness to stimuli from the natural environment and gain greater benefit from it [20,25,27]. At the same time, it is important to consider that these correlations may be influenced by sample and measurement biases. While our results are in line with previous studies, certain limitations in our methodology could have played a role in shaping these associations. A more detailed discussion of these aspects is provided in Section 4.1. Nevertheless, these findings suggest that HSPs are more likely to be influenced by and responsive to environmental cues and reinforce the idea that their heightened sensitivity goes beyond immediate sensory experiences, encompassing broader environmental concerns [24]. Moreover, HSPs can reduce the experience of sensory overload in natural settings, which are characterized by their tranquility and harmony [22]. Additionally, HSPs, with their heightened empathy, often extend this compassion to the natural world, empathizing with endangered species and future generations impacted by environmental degradation [20]. Furthermore, nature can trigger deep emotional reactions in sensitive individuals, such as HSPs, who have stronger emotional responses [23]. Finally, HSPs are characterized by aesthetic sensitivity and potentially possess a profound appreciation for the beauty and fragility of the natural world [6]. Thus, the HSP trait can be linked to a stronger environmental identity, higher levels of eco-anxiety, and more pronounced pro-environmental attitudes and behaviors. In fact, the biophilia hypothesis suggests that humans have an innate biological affinity for nature, shaped by evolutionary pressures [47]. Given their heightened sensory processing and intense emotional responses, HSPs may experience a stronger biophilic drive than non-HSPs. This could help explain why HSPs tend to report a stronger environmental identity. Indeed, according to Belk's extended self theory [28], individuals incorporate external objects and environments into their self-concept, meaning that damage to these external elements is perceived as a personal loss. This could explain why HSPs, with their deep emotional and sensory engagement with nature, might perceive environmental degradation as a personal threat. Such a perception may amplify their concern for the environment and lead to stronger pro-environmental attitudes and subsequent behaviors, as explained by the TRA [31]. Furthermore, eco-anxiety in HSPs may arise because they view nature's destruction as a form of self-harm, triggering emotional distress. To protect their extended self, HSPs may engage more actively in environmental activism as a psychological defense mechanism, seeking to mitigate the harm they perceive and reconnect with the world around them.

However, a detailed analysis of the individual dimensions of HSPs reveals some exceptions to the overall trend that merit further exploration for a more comprehensive understanding of the phenomenon. Specifically, although H3 is generally supported, ease of excitation does not show a significant or only marginal association with the conservation and environmental citizenship dimensions of PEBs, thus not fully supporting hypotheses H3a. Instead, it demonstrates a significant and positive correlation with behaviors related to food and transportation. This may be because individuals high in ease of excitation are likely to experience more intense emotional responses to immediate and tangible stimuli, such as the sensory aspects of food and transportation. They might be overwhelmed by these immediate stimuli, leading to quicker and stronger reactions compared to more abstract environmental issues, which may not trigger the same level of immediate emotional response [3]. The low sensory threshold also demonstrates similar correlations with dimensions of PEBs, thus not fully supporting H3c. This observation may similarly be attributed to the immediacy of stimuli, as both food and transportation are more immediate in nature and thus more likely to exceed the sensitivity threshold compared to more abstract concepts [3]. Additionally, the low sensory threshold dimension appears to show minimal or no connection with the attitudinal factors assessed by CCAS, indicating that hypothesis H2c cannot be confirmed. A potential explanation for this finding is that heightened sensitivity to sensory stimuli may not directly correlate with broader environmental concerns. Instead, HSPs might prioritize managing their personal sensory experiences over addressing wider environmental issues [3]. Finally, while H1 and H3 are generally supported across all dimensions, the results indicate that the aesthetic sensitivity dimension, in particular, is most consistently linked with both CTN and all PEB dimensions examined in this study, confirming H3b. In fact, unlike ease of excitation and low sensory threshold, which primarily focus on the intensity and immediate impact of sensory stimuli, aesthetic sensitivity encompasses a deeper and more enduring engagement with the natural world. So, individuals high in aesthetic sensitivity may be more motivated to protect and preserve the environment due to their strong emotional and aesthetic responses to nature's beauty [48,49]. These findings underscore the complexity of SPS and its nuanced impact on environmental dynamics, suggesting that future research should continue to explore these relationships in more depth.

4.1. Limitations and Future Perspectives

This study has several limitations. Notably, its cross-sectional design constrains our ability to infer causality among the examined variables. While we have observed significant correlations, it is important to acknowledge that these relationships do not imply causality, and future research employing longitudinal or experimental designs would be necessary to establish directionality. Another key limitation concerns the sample, which was recruited using non-probabilistic, online methods. This approach introduces the possibility of sampling bias, limiting the generalizability of the findings to a broader population. Specifically, the sample was predominantly composed of cisgender women with an average age of 27.69, which may restrict the diversity of perspectives and experiences represented. Future studies should aim to recruit more diverse samples in terms of gender, age, and cultural background to enhance the external validity of the results. Additionally, due to a lack of access to the updated version of the Highly Sensitive Person Scale [6], we used an earlier version [3]; future studies could benefit from applying the updated scale to enhance validity. Moreover, it is worth considering that certain measurement biases may have influenced the results. For instance, the reliance on self-reported data may have introduced social desirability bias or other response biases, particularly given the personal nature of the constructs measured. Future studies could incorporate additional objective

measures or multi-informant data to mitigate these potential biases. To advance research in this area, it is essential to replicate the proposed model across varied contexts and with independent samples. Although our study suggests that highly sensitive people (HSPs) tend to develop more favorable attitudes toward nature, it would be valuable to explore the implicit dimension of attitudes toward climate change [50]. This exploration would help determine whether there is a relationship between implicit and explicit attitudes, specifically whether HSPs who exhibit a more favorable explicit attitude toward climate change also possess an internalized, implicit positive attitude. While the relationship between sensory processing sensitivity (SPS) and connection to nature is an emerging field of research, there is a notable lack of cross-cultural comparative studies directly examining this link. The existing literature offers insights into related aspects, such as cultural variations in sensory perception, awe experiences, and environmental engagement. These limitations emphasize the need for future cross-cultural investigations to establish a more nuanced understanding of how SPS influences nature connectedness in diverse cultural settings. Future studies could also integrate a readiness-to-change scale [51] to assess the readiness for change among individuals with HSP traits. As highlighted in this paper, the HSP trait is characterized by heightened emotional reactivity to eco-anxiety, making highly sensitive people more susceptible to intense emotional responses to environmental changes. Future research should aim to investigate the role of other climate-related emotions beyond eco-anxiety to better understand the hyperactivation of the HSP trait in response to a broader spectrum of emotions associated with climate change (e.g., climate irritation, climate hopelessness, climate anger, and climate guilt; [52]).

4.2. Implications

In terms of pragmatic implications, recognizing the unique experiences of HSPs in relation to nature can inform environmental education and advocacy strategies. Understanding that HSPs are more emotionally and sensory responsive to their environment, educational programs could be designed to align with these sensitivities. Tailored interventions could focus on creating emotionally engaging, yet calming experiences in nature, fostering deeper connections to the environment. Such programs could encourage pro-environmental behaviors, as HSPs are more likely to engage with nature when they feel a personal and emotional bond to it. For instance, activities that emphasize mindfulness, sensory engagement, or nature-based reflection could help HSPs form a stronger emotional attachment to natural spaces, leading to greater environmental awareness and action.

Furthermore, in the context of nature conservation, understanding the heightened sensitivity of HSPs can also be applied to advocacy and conservation strategies. Conservation messages could be more effective if they appeal to the sensory and emotional aspects of environmental issues, such as focusing on the loss of biodiversity or the sensory impacts of habitat destruction. By framing conservation in a way that resonates emotionally, such as showcasing the beauty and fragility of natural environments, it may evoke a stronger response from HSPs, motivating them to participate in activism.

Moreover, creating environments that reduce sensory overload, such as quiet areas in nature reserves or reducing human activity in ecologically sensitive areas, could foster a more welcoming and engaging space for HSPs to connect with nature. This, in turn, can lead to more active participation in conservation programs and a broader cultural shift towards sustainability. By promoting practices that align with HSPs' sensitivity, such as eco-friendly policies or low-impact recreation, conservation efforts may see stronger community involvement.

5. Conclusions

The present study highlights the intricate relationship between SPS and environmental dynamics among HSPs. The findings suggest that HSPs possess a unique emotional connection with nature, which not only aids in emotional recovery but also amplifies their concern for environmental issues. This connection underscores the potential for HSPs to develop a strong environmental identity, higher levels of eco-anxiety, and more pronounced pro-environmental attitudes and behaviors. Their deep emotional ties to nature foster an increased awareness of ecological issues and a heightened responsiveness to environmental threats, allowing them to react more empathetically and proactively when confronting ecological challenges.

However, the analysis reveals complexities within the individual dimensions of SPS that invite deeper exploration into how different aspects of SPS interact with environmental attitudes and behaviors. To build on these findings, future studies should explore the implicit dimensions of environmental attitudes, such as how HSPs' implicit attitudes toward climate change might differ from their explicit attitudes. Additionally, integrating scales that assess individuals' readiness to change could provide insights into HSPs' potential for adopting sustainable behaviors. Exploring the role of other climate-related emotions (e.g., climate anger and guilt) in HSPs' responses could further illuminate the emotional dynamics at play.

The findings of this study highlight the importance of recognizing HSPs' emotional connection to nature when developing environmental policies and educational programs. Tailored interventions that foster emotional engagement while reducing sensory overload can enhance their pro-environmental behaviors. Creating sensory-friendly spaces and incorporating these strategies into climate change education can increase HSPs' participation in environmental activism, strengthening their role as advocates for sustainability.

Overall, this study underscores the importance of acknowledging the complexities of sensitivity in environmental contexts and highlights the significant potential for HSPs to play a pivotal role in advocating for environmental sustainability and conservation. By understanding and addressing their unique needs and perspectives, we can empower HSPs to become influential advocates for the protection of our natural world.

Author Contributions: Conceptualization, M.D., M.F. and A.G.; methodology, M.D. and A.G.; formal analysis, M.D. and A.G.; investigation, M.F., M.B. and F.P.S.; data curation, A.G.; writing—original draft preparation, M.D., M.F., M.B., F.P.S. and G.V.; writing—review and editing, M.D., G.V. and A.G.; supervision, M.D. and A.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was approved by the Comissão de Ética do Centro de Estudos Sociais (CE-CES) (University of Coimbra; date: 24 October 2022; protocol number: 02319461).

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.

Acknowledgments: We thank the European Union's Horizon 2020 Project "PHOENIX: The Rise of Citizen Voices for a Greener Europe" (grant agreement No 101037328) for supporting and promoting this work.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Summary of the scales used in this study, including authors, number of items, and reliability indices.

Scales and Authors	Number of Items	Dimensions	Reliability (Cronbach's α)
Highly Sensitive Person Scale (HSPS; Aron & Aron, 1997 [3])	27	Three dimensions: ease of excitation, aesthetic sensitivity, and low sensory threshold	0.89 (Cronbach's α : EOE = 0.81; AES = 0.72; LST = 0.78)
Connectedness to Nature Scale (CTN; Mayer & Frantz, 2004 [34])	14	Unidimensional	0.84
Climate Change Attitude Survey (CCAS; Christensen & Knezek, 2015 [39])	15	Two dimensions: beliefs and intentions	0.78 (Cronbach's α : beliefs = 0.90; intentions = 0.78)
New Ecological Paradigm (NEP; Dunlap et al., 2000 [40])	15	Unidimensional	0.83
Pro-Environmental Behavior Scale (PEB; Markle, 2013 [42])	19	Four dimensions: conservation, environmental citizenship, food, and transportation	0.76 (Cronbach's α : conservation = 0.74; environmental citizenship = 0.65; food = 0.66; transportation = 0.62)
Hogg Eco-Anxiety Scale (EA; Hogg et al., 2021 [43])	13	Four dimensions: affective symptoms, rumination, behavioral symptoms, and personal impact	0.93 (affective symptoms = 0.92; rumination = 0.90; behavioral symptoms = 0.86; personal impact = 0.88)

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