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Emotional Responses of Conservation Researchers to Climate Change and Its Influencing Factors

Verónica Iñiguez-Gallardo [1*] , ***Daniela Lenti-Boero*** [2], ***Fabián Reyes-Bueno*** [1]

[1] *Departamento de Ciencias Biológicas y Agropecuarias, Universidad Técnica Particular de Loja, San Cayetano alto s/n, Loja 1101608, Ecuador*

[2] *Independent Researcher, Valle d'Aosta, Italy*

ABSTRACT

Climate change has well-documented psychological consequences for society. However, the emotional experiences of frontline conservation professionals remain underexplored. As key knowledge producers and participants in decision-making processes, conservation researchers play a crucial role in shaping and implementing adaptation and mitigation efforts, which are pivotal for effective climate planning. Understanding their emotional responses is essential for enhancing the success of these strategies and supporting climate action. This study aims to identify the most prevalent emotions experienced by conservation researchers regarding climate change across various countries and to examine the qualitative and quantitative factors shaping these emotions. An online survey was conducted with 362 participants from 98 academic and research institutions, utilising both closed and open-ended questions to capture demographic data, climate knowledge, stances on mitigation and adaptation, and emotional responses. Data analysis revealed that feelings of powerlessness, guilt, and concern were most frequently reported, driven by a profound sense of inability to halt climate change, frustration with perceived inaction by governments and industries, and self-assessed personal shortcomings. Age and stances on climate adaptation were identified as primary factors influencing emotional responses, particularly among individuals aged 20–50 and 61–70, with opposition to adaptation correlating with stronger emotional reactions. Demographic factors such as region, place of residence, and mitigation stances played a minor role. These findings provide valuable insights into the

*CORRESPONDING AUTHOR:

Verónica Iñiguez-Gallardo, Departamento de Ciencias Biológicas y Agropecuarias, Universidad Técnica Particular de Loja, San Cayetano alto s/n, Loja 1101608, Ecuador; Email: mviniguez1@utpl.edu.ec

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psychological well-being of conservation researchers related to climate change.
Keywords: Psychological Impact; Emotions; Climate Change; Adaptation; Conservation; Climate Action

1. Introduction

Climate change is a pressing global issue, with widespread social, environmental, and psychological consequences [1] including long-term effects as it poses an existential threat to a larger population [2, 3]. The conception of a changing climate is known to induce psychological distress and anxiety about the future, leading to the concept of "eco-anxiety," which the American Psychological Association defines as a chronic fear of environmental doom [4]. Numerous authors have operationalised eco-anxiety as a broad spectrum of negative emotions associated with the awareness of climate change and environmental threats in adults and the young [5–7]. Among these negative emotions, prevail alarm, concern [8–10], powerlessness, [11, 12], anger, and guilt [13, 14]. Less negative emotions such as confusion, indifference, happiness, calm, and optimism have also been reported to a lesser extent [12, 15, 16].

Among the general public, growing concern about the climate crisis is influenced by a range of factors, including climate knowledge, gender, age, country of residence, income, and place of residence [17–21]. Despite the large body of research on public concern about climate change, there is a critical gap in understanding how these factors influence the emotional responses of individuals directly involved in climate-related fields, such as conservation researchers. These professionals, who engage with the impacts of climate change through their work, are deemed susceptible to eco-anxiety [22] and may experience heightened climate-related emotions. These researchers express deep concern regarding biodiversity loss exacerbated by climate change effects [23, 24]. Their unique emotional responses, driven by their expertise and exposure [25], are not well understood.

This gap represents a significant problem. Conservation researchers are pivotal in producing knowledge and influencing climate policies by collaborating with decision-makers [26, 27]. They also play roles as educators for future generations, conveying attitudes and emotions about climate change through verbal and non-verbal communication [28, 29], yet their emotional well-being and responses to the crisis are rarely addressed. The limited research on researchers mainly delves into their perceptions and opinions on climate change [23, 30–33]. Understanding these emotions is essential not only for supporting their mental health and resilience but also for improving the effectiveness of their conservation work. Emotional responses to climate change may influence decision-making, research priorities, and attitudes towards adaptation and mitigation strategies, potentially affecting the quality and direction of conservation efforts.

This study aims to explore the climate-related emotions experienced by conservation researchers and the variables influencing these emotions. Specifically, the objectives are a) to identify participant's knowledge of climate change and stances towards mitigations and adaptation, b) to identify the most prevalent emotions, c) to analyse the qualitative factors triggering these emotions, and d) to outline a pattern of interacting variables—including demographic factors, climate knowledge, and stances towards mitigation and adaptation approaches—, that shape these emotional responses.

2. Methods

2.1. Oline Questionnaire

We employ an online questionnaire for cost-effective data collection and access to specific interest groups. The original questionnaire was translated from Spanish to English and piloted with conservation graduate students (10 per language). It was then validated by a panel of ten psychologists, one meteorologist, one climatologist, five ecologists, three agricultural experts, and five social communicators. The panel assessed psychometric, epistemological, and linguistic aspects of the questionnaire. The validation process was documented and published as a bachelor's thesis by Espinosa [34]. The questionnaire included four sections:

a. Respondents' demographic characteristics: age, sex, place of residence, academic position, country.
b. Knowledge: three interrogatives regarding fundamental misconceptions related to public understanding of climate change including:

Climate processes (Likert scale): How much do you agree or disagree with the following items?

1. The greenhouse effect keeps the air from being as cold as outer space.
2. Climate change occurs because greenhouse gases are trapped in the atmosphere.
3. Climate can be affected by launching dust into the atmosphere.
4. Ice sheets in the poles help to cool the planet.
5. Oceans help to reflect the sun radiation.
6. Clouds influence the earth's temperature.
7. The temperature of the Earth is affected by whether the earth's surface is light or dark coloured.

Greenhouse gases (checklist of multiple options): Select all the greenhouse gases you know: Carbon dioxide, methane, nitrous oxide, water vapor, ozone, aerosols.
Climate change and global warming (Likert scale): How much do you agree or disagree with the following items?

1. Climate change is the same as global warming.
2. Global warming is occurring because the climate is changing.
3. Cold weather means the same as cold climate.
4. Climate often changes from year to year.
5. Climate means pretty much the same as weather.
6. A warmer or colder year is an indicator of climate change.
7. The melting of sea ice in the polar oceans causes sea levels rise.
8. By stopping the emissions of CO_2 to the atmosphere we will stop global warming.
9. Intensive agricultural practices contribute to climate change.
10. Floods, tornados, and hurricanes occur in more frequency because climate is changing.

c. Stances towards climate change adaptation and mitigation (Likert scale): these items were drawn from previous research [31, 33]. How much do you agree or disagree with the following items?

1. Humanity must adapt to climate change and move on.
2. Humanity should stop CO_2 industrial emissions.

d. Emotional responses (checklist of multiple options): a list of 10 emotions (concern, guil, angry, confusion, calm, powerless, happiness, optimism, indifference, and scepticism), was accompanied with an open-ended question to give participants the agency to declare the reasons for experiencing the emotions selected. While not an emotion, scepticism was included due to its frequent mention in climate change studies.

2.2. Sampling

We considered potential limitations regarding representativeness for comparative studies across multiple populations, which requires a minimum of 30 cases per subgroup to ensure external validity, with an additional 30 percent to minimize non-response rates in online questionnaires [35]. As a result, the sample size was determined to be 39 individuals per country.

Participants eligible for the study included lecturers, scholars, professors, postgraduate researchers, and research assistants working in all areas of conservation. Respondents were required to be associated with any university or scientific institution, either on a full-time or part-time basis. We employed a snowball sampling strategy, initiating with the research team's immediate contacts participating in the online survey and assisting in its global dissemination. The survey template included the principal investigator's email for participant communication ensuring anonymity and confidentiality. The survey garnered responses from 362 participants representing 98 academic institutions across 36 countries. The target of 39 respondents per country was not met, therefore the countries were grouped based on their geographical region, with North America, Latin America, and Europe having sufficient sample sizes for further statistical inferences and comparisons. The remaining countries belonging to Africa, Oceania, Asia, and the Middle East were grouped together as "Other Regions". However, given their modest representation, constituting only 4% of the sample, they were excluded from the subsequent analysis. Participants' demographics are available in **Table 1**.

2.3. Data Analysis

Data on climate knowledge and stances on mitigation and adaptation were analysed through an exploratory analysis. Emotions were analysed to obtain qualitative and quan-

Table 1. Participant's demographics.

Gender				
Male: 54%		Female: 46%		
Age				
20–30: 42%	31–40: 38%	41–50: 8%	51–60: 6%	61–70: 6%
Place of residence				
Urban: 73%	Rural: 13%	Suburban: 15%		
Academic occupation				
Master's student: 20%	PhD Student: 32%	Lecturer: 28%	Research Assistant: 16%	Other: 3%
Country				
Europe: 50% (England, Germany, France, Spain, Switzerland, Poland, Romania, Belgium, Portugal, Italy)	Latin American: 35% (Ecuador, Chile, Brazil, Argentina, Colombia, Mexico, Costa Rica, Puerto Rico)	North American: 11% United States (n = 36) Canada (n = 5)	Other regions: 4%	

titative results. First, we conduct an exploratory analysis to identify the most selected emotions. The open-ended responses explaining the selected emotions were manually coded and organised for pattern detection and content analysis, following the protocol by Iniguez-Gallardo [12]. This process involved counting and categorising elements based on the type and frequency of specific codes (words) that were repeated. The goal was to identify mutually exclusive categories based on a single concept, ensuring each response was assigned to only one category, e.g., the category "Politicians, world leaders, industries" encompassed any reference to the actions and discourses of these entities (**Table 2**).

For identifying influential factors, first the database was refined by selecting the columns corresponding to the independent variables: age, sex, place of residence, region (country), and academic position, as well as the dependent variables: knowledge, stances, and emotions. Subsequently, all rows containing either null values (no data) or categories with less than 5% of representativeness, were removed. Finally, categorical variables were transformed into the factor type.

After refining the data, an explanatory analysis was conducted due to its heightened significance, offering a nuanced understanding of interconnections between independent variables and emotional responses. Subsequently, graphical representation was used to display response percentages for each mentioned independent variable. For mitigation and adaptation stances, knowledge was integrated as independent variables along with the previous ones; for emotions, both knowledge and stances acted as independent variables.

The explanatory analysis was separately conducted for dependent variables with numeric values (knowledge) and those with categorical values (stances and emotions). For the knowledge analysis, we commenced by assessing Likert scale responses to gauge respondents' confidence levels in their answers for each item. If participants answered correctly, a value of 1 was assigned; otherwise, a value of 0 was assigned. The resulting values were averaged to obtain the final knowledge score. Furthermore, a multiple linear regression model (lm) we employed to complement the findings from the exploratory analysis.

For the adaptation and mitigation stances, a distinct analysis was applied. The dataset was partitioned into training (70%) and test (30%) subsets. Using the training data, we employed the "rpart" method [36] within the "train" function from the caret package [37] to generate a decision tree model. Decision trees, powerful learning algorithms for data classification, leverage distinctive characteristics to identify patterns within the data, complementing descriptive analysis and providing valuable insights into otherwise unseen multivariate relationships. To establish the optimal complexity parameters, a tuning strategy was implemented on the 70% subset through 10-fold cross-validation, utilizing the rpart method with 100 repetitions. We then assessed the model's performance using the test data, culminating in the visualisation of the decision tree.

In analysing the emotions variable, we initially encoded emotions using three characters: the first for negative emo-

tions, the second for neutral emotions, and the third for positive emotions. Each character was assigned a value of 1 if the participant selected any corresponding emotion and 0 if not. Following the creation of these codes, we applied a similar process to the one outlined in the stances analysis to construct a decision tree. This analysis proved pivotal in identifying common behavioural patterns and establishing relationships between demographic variables, climate change knowledge, mitigation and adaptation stances, and emotional responses.

3. Results

3.1. Participant's Knowledge of Climate Change

Participants needed to express either agreement or strong agreement to assess their climate knowledge. The results revealed that while a significant majority agreed, approximately 30% disagreed with certain statements 1) *The greenhouse effect keeps the air from being as cold as outer space*, 4) *Ice sheets in the poles help to cool the planet*, and 5) *Oceans help to reflect the sun radiation* (**Figure 1**).

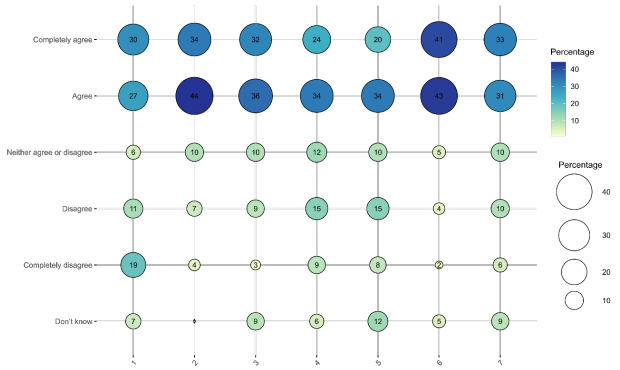

Figure 1. Percentage of level of agreement of 362 academic conservationists with seven knowledge statements on climate processes. 1. The greenhouse effect keeps the air from being as cold as outer space; 2. Climate change occurs because greenhouse gases are trapped in the atmosphere; 3. Climate can be affected by launching dust into the atmosphere; 4. Ice sheets in the poles help to cool the planet; 5. Oceans help to reflect the sun's radiation; 6. Clouds influence the earth's temperature; 7. The temperature of the Earth is affected by whether the earth's surface is light or dark coloured.

In a separate question, participants selected greenhouse gases from a list of six items. The majority correctly identified carbon dioxide (97%) and methane (86%), and a significant portion recognised Nitrous Oxide (51%). Notably, over half did not identify water vapor (57%), ozone (72%), and aerosols (61%) as greenhouse gases.

The third question aimed to assess participants' knowledge of fundamental definitions like weather, climate, climate change, and global warming. Participants were required to strongly disagree or disagree with the first eight statements and agree or strongly agree with the final two statements. Results revealed varied knowledge levels, with the majority demonstrating a solid grasp (**Figure 2**). Notably, while a significant proportion of respondents correctly answered statements: 4) *Climate often changes from year to year* and 8) *By stopping the emissions of CO_2 to the atmosphere we will stop global warming*, a noteworthy 49% responded inaccurately. For statements: 2) *Global warming is occurring because the climate is changing* and 7) *The melting of sea ice in the polar oceans causes sea levels rise*, only 34% and 14% answered correctly, respectively.

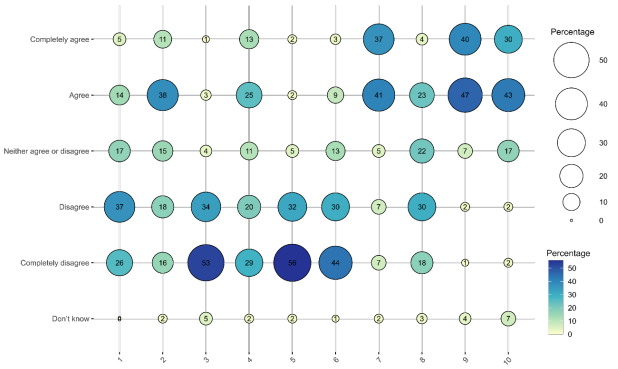

Figure 2. Level of agreement of 362 conservation researchers on 10 statements regarding their level of agreement or disagreement with the following knowledge statements: 1. Climate change is the same as global warming; 2. Global warming is occurring because the climate is changing; 3. Cold weather means the same as cold climate; 4. Climate often changes from year to year; 5. Climate means pretty much the same as weather; 6. A warmer or colder year is an indicator of climate change; 7. The melting of sea ice in the polar oceans cause sea levels rise; 8. By stopping the emissions of CO_2 to the atmosphere we will stop global warming; 9. Intensive agricultural practices contribute to climate change. 10. Floods, tornados and hurricanes occur in more frequency because climate is changing.

3.2. Participants' Stances towards Climate Mitigation and Adaptation Approaches

Most respondents leaned towards mitigation. Only 19% of the participants agreed with the adaptation statement (Humanity must adapt to climate change and move on), with over 50% expressing disagreement. Conversely, a notable 63% agreed with the mitigation statement (Humanity should

stop industrial CO_2 emissions), while only 8% disagreed.

3.3. Climate Emotions Experienced by Conservation Researchers

The majority of respondents selected 'impotent', 'guilt', 'concern', 'anger', 'confused', and 'optimistic'. About 12% chose 'scepticism', while 'calm' and 'indifference' were less frequent; none selected 'happiness' (**Figure 3**). Emotions were categorised as positive, negative, or neutral. Confusion was categorised as neutral due to its dual impact on learning outcomes —either beneficial or detrimental—[38, 39]. This framework, which addresses how learners handle conflicting information, was applied here. Results show that 51% selected only negative emotions, 11% both negative and neutral, 7% a mix of positive and negative, and 7% only neutral emotions. A small proportion (3%) exclusively selected positive emotion.

Figure 3. Percentage of emotions selected by conservation scientists on climate change (n = 362).

3.4. Qualitative Factors Contributing to the Emotions Experienced

Open-ended responses revealed diverse reasons for the emotions analysed (**Table 2**). Participants who chose 'powerlessness' offered 108 reasons categorised into four groups: limited control over the phenomenon (51%), helplessness towards politicians, world leaders, and industries (21%), frustration in influencing others' behaviour (20%), and personal lifestyle choices (8%).

Participants who selected 'guilt' cited 70 reasons, grouped into five categories. Key contributors were acknowledgment of responsibility for climate change, either individually (24%) or collectively as humanity (36%), and guilt about personal lifestyle choices (29%).

Those selecting 'concern' provided 101 reasons, organised into eight categories. The leading causes were a sense of impending doom (30%), unease about an uncertain future (23%), and a perception that others disregard the phenomenon and its potential consequences (14%).

Participants who felt 'anger' contributed 79 reasons, categorised into seven groups. Major factors included frustration with perceived ineffective efforts (33%), dissatisfaction with inaction (20%), and belief in significant governmental influence (18%). Other reasons encompassed discontent with uneven responsibility (9%), concern for future generations (7.5%), the use of intensified language such as "stupid" or "idiot" to express frustration (7.5%), and distress over misinformation (5%).

For 'confusion,' 65 reasons were grouped into six categories. Primary causes included uncertainty or doubt (55%), lack of knowledge (18%), and disbelief in others' actions (11%). Participants selecting 'optimism' offered 47 reasons, categorised into four groups. Most expressed optimism —first-person singular and plural— through ongoing or anticipating action (34%), belief in people's best efforts (32%), societal resilience (28%), and confidence in science and technology (6%).

Participants selecting 'scepticism' provided 33 reasons, grouped into five categories. Main factors cited disbelief in the information presented (33%), distrust in politicians' willingness to act (30%), and belief in natural climate change (21%). For 'calm' 36 responses were grouped into three categories, with a significant proportion reflecting relaxation, either due to residing in a privileged country or perceiving climate change as a future threat (56%). Finally, the few respondents selecting 'indifference' provided seven reasons, which mainly expressed a preference for remaining quiet about the issue.

3.5. Factors Influencing Emotional Responses

The classification tree identified five groups: two with predominantly negative emotions, two with mostly negative or neutral emotions, and one with primarily neutral emotions. Age and adaptation stances were key influences, while region, mitigation stances, and residence played minor roles (**Figure 4**).

Groups selecting only negative emotions: the first group, 58% of the sample, disagreed with adaptation measures, with 62% aged 20–50 and 61–70. The second group, 26% of the sample, agreed or were neutral on adaptation but supported mitigation, with 42% selecting negative emotions and 28% a mix of negative and neutral emotions.

Groups selecting negative and neutral emotions: the

first group, accounting for 6% of the sample, includes individuals who expressed disagreement with the adaptation measures and falls within the age of 51 to 60. Within this group, 58% selected either negative or neutral emotions, with the remaining 42% choosing only negative emotions. The second group, representing the 7% of the sample, encompasses individuals who either agreed or maintained a neutral stance towards adaptation, while expressing disagreement or neutrality towards mitigation. This group primarily consists of individuals aged 20–30, and between 51–60, accounting for 50% of this group.

Group selecting neutral emotions: within the same branch of negative and neutral emotions, a parallel branch emerged including individuals aged 31–50 and 61–70, comprising predominantly neutral emotions (43%). Notably this group has a relatively higher percentage (29%) of exclusively positive emotions, though it constitutes only three percent of the sample.

Table 2. Examples of answers provided by conservation scientists for selecting a particular emotion from the cluster.

Emotional States	Examples of Respondent's Answers	Categories	%
Powerlessness n = 108	*"Big changes can only be done by politicians and big industries" "I can't do much, my possibilities as a citizen are limited to elections and any party really wants to do something" "My government and other world leaders are not doing enough to prevent climate change" "I feel it is only change in big industry that will make a difference and the political will is not there" "What to do against the major industry" "Some countries do not want to do anything (USA) and I can't do anything about this" "Big contributions are not being taken by the big industries and the big polluting countries (Europe, China, North America)"*	Politicians, world leaders, industries	21
	"It's too late to stop it" "Even if I change my life drastically climate change would continue" "Even if we reduce industrialization and other human activities, we won't be able to reverse it" "It seems such a big unsolvable problem" "I feel that what I do is a drop in the ocean" "It is a necessary evil to reach development"	I cannot stop it.	51
	"People do not seem overly concerned" "It is difficult to change the behaviour of billions of people" "When I do something in my community, I don't see any effect on people"	I cannot influence on others	20
	"Although I try to do my best, I know I still do things that are negative for environment" "It is hard not to contribute considering my lifestyle"	My lifestyle	8
Guilt n = 70	*"I don't do everything that I could to reduce my own impact and emissions" "I don't feel like am contributing in any way to solve the problem"*	I do not do enough	24
	"I have not done enough in my lifetime to stop this tragedy from happening" "It is human fault, and I am human"	My human fault	36
	"As a westerner I feel our development has contributed considerably to climate change" "As a privileged westerner, I'm part of the culture that has most contributed to climate change" "Too much energy used in Europe" "It is the wealth that I am participating in which leads to climate change"	Climate justice: "I'm a westerner"	10
	"I am in my late 50s and my actions years ago are now baked into the CC cake" "I'm using in a daily basis product that contribute to CC" "I have not enough commitment to switch to a more natural lifestyle" "I don't want to give up to things that I know contribute to climate change" "I don't have enough money and time to live in a more sustainable way"	My lifestyle	29
	It is not my responsibility but the responsibility of capitalist industrialisation, marketing, perceived obsolescence and all the other deceptions to force people to buy and waste.	Other's fault	1

Table 2. *Cont.*

Emotional States	Examples of Respondent's Answers	Categories	%
Concern n = 101	*"It is a global problem that will disproportionately affect the world's most vulnerable" "There are victims of climatic changes"*	Climate justice	3
	"Because it poses a life threating on a massive scale" "Human populations will suffer bad times as famine and water shortage"	Doom	30
	"The future is bleak" "Big changes with unknown consequences that are probably harmful" "Future is uncertain"	Uncertain future	23
	"The damage done is irreparable" "The things we can do seem too small to fix the problem" "Can't do anything by myself"	Big problem, I cannot tackle it	12
	"It will far-reaching but unknown implications for future generations" "My kids will grow up in changing world and I helped create that world" "I don't know if there is going to be a good future for my sons and grandsons"	Future generations	8
	"Humans are not doing enough to tackle CC" "nothing is happening to reduce human impact on climate" "Willingness to act seems to be lacking"	No one cares	14
	"My parent's generation has sucked the economy and natural resources out of the world and left us to deal with it and won't even acknowledge there is anything wrong"	Annoyed	3
	"Life loss and threats to habitats and global species" "May effect conservation of species and habitats" "the effects on biodiversity"	Biodiversity loss	7
Anger n = 79	*"We are responsible for us and future generations, but we don't take enough effort in changing our habits" "The US policy makers do nothing while our children and other species will die" "I don't know what would happen in the next years" "Don't know what the real consequences are"*	Future and future generations	7.5
	"Major countries like China and the US have not responded as needed" "Politicians should do more, but they become corrupted by industry lobbies and the discourse on economic growth" "I am horrified by behaviours of multinational corporation and countries around the world that seem to ignore the problem as long as they can make money and increase their GDP"	Politicians, world leaders, industries	18
	"People believe too easy in everything and don't use their own brain" "Because I wish people would wake up about climate change"	People	20
	"It doesn't matter our efforts, there other are people pulling the strings" "I know I should do something" "Things don't seem to improve" "We have known about this phenomenon for many years and have done nothing about it"	Frustration	33
	"About the greed involved in creating sceptic propaganda and the resulting political inaction" "There are many people who manipulate information on the subject as they please"	Misinformation	5
	"Climate change is a stupid term - if history has taught us anything, the climate was always going to change - change the terminology!" "There are so many ignorant idiots out there that wouldn't notice if the world fell apart" "Humanity is that stupid" "Pissed off at what we are doing to our only planet"	Wrath	7.5
	"Rich people destroy the future of poor folks" "The responsibility has been equally distributed, although we have reached this situation because of an unsustainable development controlled by few groups"	Climate justice	9

Table 2. *Cont.*

Emotional States	Examples of Respondent's Answers	Categories	%
Confusion n = 65	*"I have a limited knowledge about CC" "I don't have enough info to have a consistent opinion" "it's hard to know if my personal efforts can have a global impact"*	I lack knowledge or information for action	18
	"There are too many different predictions and where can we make a cut between a natural and a man-made" "Real information is hidden" "We receive a lot of information and even with a scientific background it is hard sometimes to distinguish between what is truth and false" "Conflicting messages even from the scientific community" "Contrasted discourses" "There is certainly climate change occurring (as it has over the past 4 billion years), however certain areas of the planet are definitely affected for severely and far more swiftly than in previous climatic changes (excluding meteor impacts)" "There is no complete knowledge about it" "it's a complicated process"	Uncertainty/Doubt	55
	"I don't believe in everything that is said on climate change especially politicians" "Decisions must be taken by politics"	It is politicised	6
	"Media spreads many different news" "Journalists often try to relay a message; their opinion rather than all the facts which might very well contradict"	Mass media	5
	"You can act in one way but this's about a collective process and you can't do it for the others" "Humans are supposed to be reasonable creatures but still deny that climate change is real"	People	11
	"We can die!" "I don't want climate to change" "I don't like very hot summers"	Fear	5
Optimism n = 47	*"Throughout history we have adapted to multiple situations" "I think we will go through difficult times but after all it'll be good for evolution" "We're adaptable" "It offers a new host of challenges for humanity to learn and adapt to" "What doesn't kill you it makes you stronger" "We'll probably lose charismatic entities like polar bears and coral reefs, but life will go on" "I think we have the capacity to change things"*	Adaptive capacity	28
	"We definitely have the technological means to do what is necessary" "There are scientists working on the effects, causes and public dissemination"	Science & Technology	6
	There are some who try, and we can mitigate the effects" "People's minds are changing a bit in the last years" "There are many people doing their best for a positive reaction" "Some groups or associations try to find another way, like ecocide project"	People	32
	"I'm always optimistic" "Planet Earth doesn't need us to exist" "We are trying to find and implement mechanism or strategies to adapt or mitigate climate change" "We will be forced to act sooner or later"	We can make it	34
Scepticism n = 33	*"So much bullshit has been told" "Everything is based on simplistic conclusions that are partly true" "Climate gates reduced our trust" "We need experienced scientists studying climate and open access to the information"*	I do not believe what it is said	33
	"A lot of evidence points to natural changes in climate not just greenhouse emissions" "I am unsure whether global climate change can be completely attributed to anthropogenic influence"	Natural process	21
	"Humanity won't change their lifestyle" "I do not believe that society will be able to make effective decisions"	Human actions	6

Table 2. *Cont.*

Emotional States	Examples of Respondent's Answers	Categories	%
Scepticism n = 33	*"There is no real political willingness to change things" "Politicians increases scepticism" "I have no faith in politicians and industry leaders to act adequately" "Industry overrules all environmental decisions"*	Politicians and Industries	30
	"Uncertain of what the future holds for the next generation" "about the future" "What will climate change being about?"	Uncertainty	10
Calm n = 36	*"Even if sea rises to 10 m and temperature augment 5 °C, living in France I wouldn't have to move out" "Living in a rich country I will feel the consequences less than other people" "Living in a country which can feed its own population I will feel the consequences less than others" "The planet has over 4500 million years and I am just 44, things will happen as they have to" "All predictions are for the future so neither you nor me should be worried" "My country was an ecological disaster 30 years ago and we made it less polluted, so it's not that bad"*	Relaxation	56
	"We have evolved for many years with each change" "Humans can adapt to it" "Ecosystems will react and adapt" "The evolution of the Earth (geochemical as well) will not stop in any case; in a few billion years it will not exist anymore earth experienced more severe disasters"	Adaptive capacity/natural process	30
	I feel I am doing something within my limited means that will contribute to more ecological living because humanity will become aware of its actions with respect to the planet	We can make it	14
Indifferent n = 7	*"If it exists it can be tackled by social changes" "Changes occur slowly, so at a human-timescale it does not really affects me" "I don't want to feel distressed nor do I feel optimistic" "It's out of fashion" "Everyone talks about it but no one wants to act" "It's hard to feel strongly over such a long time scale" "I think there are more important and easily solvable global issues"*	I do not want to feel distress	10

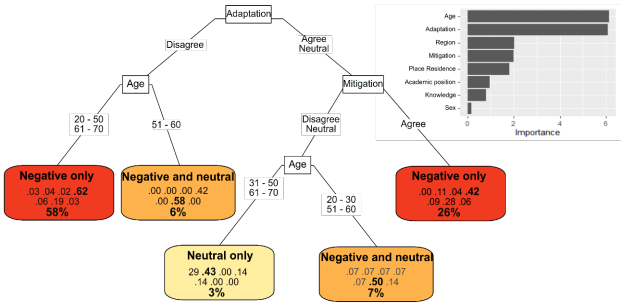

Figure 4. The emotions classification tree has a depth of 3 levels, and its Area Under the Curve (AUC) is 0.5. The bottom nodes, represented in grey, indicate the combinations of the dominant emotions selected (neutral only, negative only; negative and neutral). These grey nodes are organized into four rows. The bottom nodes, represented in grey, are organized into three rows. The bottom row displays the total percentage of the training subset assigned to each node. In the middle rows (second and third), seven decimal numbers represent the proportions of respondents in each node who selected the following emotions: positive only, neutral only, positive and neutral, negative only, negative and positive, negative and neutral, negative, neutral and positive. The upper row provides a description of the dominant value from the middle rows. The importance of the variables identified by the tree is depicted in the upper right corner of the Figure.

4. Discussion

Our findings indicate that conservation researchers exhibit commendable knowledge of specific aspects of climate change. However, there are notable deficiencies in fundamental areas, such as identifying greenhouse gases and distinguishing between climate change and global warming, bringing their comprehension closer to that of the general public [40]. The study highlights the complexity of climate change fundamentals, which can be challenging even for experts. Our data also reveal a tendency among conservation researchers to favour mitigation approaches over adaptation. Variables such as knowledge, stances of mitigation/adaptation, and other demographic variables significantly influence the climate-related emotions experienced by participants.

Negative emotions such as powerlessness, guilt, concern, and anger were the most frequently selected across all age groups except those aged 51–60, particularly among individuals disagreeing with adaptation or those who agree with adaptation but also support mitigation. Neutral emo-

tions were rare (3%) and most common among those aged 31–50 and 61–70, who had neutral or conflicting stances on adaptation and mitigation. While negative emotions can drive urgency and action [41–43], they may also lead to apathy, disempowerment, anxiety, and distress [44]. For example, climate anxiety may motivate activism in privileged groups but is negatively correlated with mental wellbeing [45]. Likewise, powerlessness may be a barrier between climate concern and effective climate action [46].

This is particularly important as participants reported high levels of distress and frustration across all negative emotions, even confusion was expressed mainly through uncertainty and doubt. For example, a substantial sense of powerlessness arose from perceived inability to halt or reverse climate change, the incapacity of governments and corporations to address climatic issues, and a self-assessed failure to influence others. Guilt was linked to self-assessed inadequacies in preventing this phenomenon and personal lifestyle choices, while concern was primarily associated with eco-anxiety and future uncertainties. Anger primarily stemmed from frustration over personal inaction, societal indifference, and the reluctance of governments and corporations to act decisively. Limited research on scientists' emotional responses to climate change does indeed document eco-anxiety, depression, and related syndromes [22, 25, 47]. For instance, Australian climate scientists report anger and frustration over society's inadequate response [48]. Similarly, US conservationists and environmental educators experience severe emotional distress, feeling overwhelmed by the climate crisis [47].

The prevalent frustration among conservation researchers, aimed at reducing biodiversity loss, necessitates measures such as mitigating greenhouse gas concentrations [49]. However, the effectiveness of these measures relies on external actions from policymakers, industries, and the broader societal community. Unfortunately, the desired reduction remains elusive, with Earth's temperature continuing to rise, leading to novel adverse impacts on biodiversity [50]. Curiously, biodiversity loss received limited attention in concern responses, overshadowed by eco-anxiety scenarios tied to an uncertain future and impending doom. Considering conservation research's focal point on the impacts of climate change on biodiversity, our findings present complexities in interpretation. We propose two likely explanations, the first lies in the foundational tenet of conservation, which centers around evolution, with adaptation being a crucial facet. Initially, it may be posited that participants perceive species to adapt to new climatic conditions, as evidenced by the causal agents declared to feel optimism and calm such as: "I think we will go through difficult times but after all it'll be good for evolution" or "We have evolved for many years with each change". The second explanation is associated with the frustration motivating participants to call for climate action from society, politicians, and industry as claimed by this participant: "I am horrified by behaviours of multinational corporation and countries around the world that seem to ignore the problem as long as they can make money and increase their GDP" This frustration is further reinforced by a prevailing pro-mitigation stance among participants, which aligns with global conservation experts advocating for biodiversity preservation, primarily through limiting or preventing greenhouse gas emissions [50].

Addressing climate change necessitates both adaptation and mitigation actions, rendering both perspectives acceptable within the conservation domain. It may also be deemed acceptable that climate change predominantly elicits negative emotions, given the magnitude of its impacts. What merits attention are the causal agents of these emotions predominantly demanding third-party action due to a self-perceived incapacity for individual action. This revisits the earlier assertions regarding the influence of negative emotions on creating barriers to effective climate action, a predisposition that may foster a catastrophic and dystopian perspective often depicted in science fiction media and embraced by some within the scientific community [51]. Positive emotions, on the other hand, have the opposite effect, as they play an essential role in sustaining actions that contribute to transformative change and help catalyse the action required to address the biodiversity crisis [44]. Although it was a small percentage, there were also participants who selected neutral and even positive emotions indicating a more optimistic perspective on humanity's ability to adapt to changing climate.

Our data further revealed that confusion, ranked fifth in emotions, stemmed from factors like lack of knowledge and perpetuation of anthropogenic vs. natural climate change false dichotomy. Addressing this cognitive disequilibrium is essential for transitioning from confusion to an engaged state. Failure in this process may result in frustration [38],

causing information overload[52] and uncertainty about how to act.

Our results highlight the need for a deep understanding of the emotional landscape within this scientific community. This is deemed important as researchers face challenges in influencing governments to avert further deterioration, necessitating a profound shift in their societal engagement and a call for adopting a specific advocacy stance[53]. Conservation scientists bear the sentinel responsibility of alerting society to threats not readily apparent to the layperson[54]. To fulfill this duty effectively, heightened attention to their emotional responses is essential for informed decision-making and effective communication. Understanding underlying causal factors in the emotional responses is paramount, as varied emotions can lead to diverse and sometimes contradictory actions in mitigation and adaptation efforts[55, 56].

The multifaceted roles of conservation researchers as knowledge producers, educators, and collaborators with policymakers make them a key group for the analysis of emotions, which significantly influence the scientific process, guiding research priorities and perspectives. This is evident in scientists' emphasis on reporting climate change consequences, while avoiding active advocacy[53]. In educational settings, scientists must navigate a delicate balance between conveying climate change urgency and maintaining objectivity. However, scientists who feel overwhelmed, may prioritise other tasks, potentially deprioritising the importance of communication efforts[30]. Collaborations with policymakers necessitates the integration of emotions into scientific training recognizing that scientists' convictions shape the recommendations they provide[27]. This becomes particularly significant when acknowledging that 12% of participants, expressed scepticism regarding climate change.

Recognising and comprehending the emotional dimensions of climate change among conservation researchers is essential for fostering effective communication, promoting evidence-based decision-making, and addressing the interdisciplinary challenges inherent in climate change mitigation and adaptation. This involves guiding them toward the communication of lucid messages that prompt concrete actions, capable of cultivating positive attitudes among the general population.

Caveats

Given the limited size of the North American sample, these findings may vary with a larger sample size. Further in-depth research within this population is strongly encouraged.

Unexplored factors not addressed in this study, such as political context and orientation, maybe significant, especially considering participants' frequent references to governmental action on climate-related issues. Similarly, the participants' scientific discipline could be a significant factor. Despite calls to encourage interdisciplinary collaboration in addressing climate change's impact on socio-ecological systems[57], ecological concerns persist as dominant conservation agendas. This study did not inquire about the discipline from which conservation is approached. Therefore, it is recommended to conduct further research examining the correlation between knowledge, stances towards mitigation and adaptation, and emotions considering the scientist's discipline.

5. Conclusions

This cross-national study highlights the emotional responses of conservation researchers to climate change and the variables influencing such emotions. The results reveal that individuals aged between 20–50 and 61–70, and those who disagree or hold a neutral stance towards adaptation, but also agree or hold a neutral stance towards mitigation, tend to experience negative emotions, particularly pervasive frustration in the face of substantial and enduring climate challenges. By acknowledging the impact of age and stances toward mitigation and adaptation, we enhance our understanding of the emotional dimensions within the conservation scientific community. As knowledge producers and key participants in decision-making processes for implementing adaptation and mitigation efforts, conservation researchers play a pivotal role in climate planning. Understanding their emotional responses is essential for improving the effectiveness of these strategies. Overall, our research contributes to the expanding knowledge on the emotional repercussions of climate change, laying the groundwork for further exploration and targeted interventions to improve climate change communication and action among scientists and the general public.

Author Contributions

V.I.-G.: Conceptualization, Methodology, Data curation, Writing—Original draft preparation. D.L.-B.: Conceptualization, Data curation, Writing. F.R.-B.: Data curation, data analysis.

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Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Participants in this study were informed of their rights and the purpose of the research through a clear statement at the beginning of the questionnaire. The survey included a headline explicitly requesting participants' consent to participate by proceeding with the questionnaire.

The statement assured participants that their responses would remain completely confidential and anonymous. No personally identifiable information was collected, and all data were used solely for academic and research purposes. By continuing with the questionnaire, participants acknowledged their informed consent to voluntarily contribute to the study.

Data Availability Statement

The datasets presented in this article are not readily available because the raw data supporting the conclusions of this article will be made available by the authors only for future joint work between authors and stakeholders. Requests to access the datasets should be directed to VI-G, mviniguez1@utpl.edu.ec.

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Conflict of Interest

The authors report there are no competing interests to declare.

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