Psychometric Properties of the Hogg Eco-Anxiety Scale (HEAS-13) and the Prediction of Pro-Environmental Behavior

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Kutlu Kagan Türkarslan: Conceptualization, methodology, participant recruitment, data collection, data analysis, writing -original draft, writing – review and editing, project administration.

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Abstract

Objectives: Eco-anxiety, a novel conceptualization of anxiety in relation to ecological problems, has become a significant subject of interest in psychology. The Hogg Eco-Anxiety Scale (HEAS-13) is a recently developed, valid, and reliable measure of eco-anxiety. The present study aimed to investigate the psychometric properties of the HEAS-13 in Turkish-speaking samples.

Methods: 605 individuals, recruited via social media and the internet, participated in the study. The sample was randomly split in half (first sample, 69.00% and second sample, 70.90% females), and exploratory and confirmatory factor analyses were conducted on separate samples. The concurrent and incremental validities were evaluated in the total sample. The three-week test-retest reliability of the HEAS-13 was assessed in a third separate sample (83.13% females).

Results: Exploratory and confirmatory factor analyses found and validated a four-factor structure with 13 items. The associations of HEAS-13 with concurrent measures indicated that the scale had good concurrent validity. The anxiety and behavioral symptoms subscales of the HEAS-13 explained the additional variance (6.60%) in pro-environmental behavior beyond activist identity and commitment. Finally, the HEAS-13 and its subscales had good internal consistency coefficients, ranging from 0.82 to 0.93. and mediocre three-week intra-class correlations, ranging from 0.47 to 0.56.

Conclusion: The Turkish HEAS-13 was a valid and reliable measure of eco-anxiety that can be used to assess anxiety about ecological problems. Moreover, optimizing levels of anxiety symptoms, alleviating behavioral symptoms, and enhancing individuals' activist identity and commitment may be targets for interventions aiming to increase pro-environmental behaviors.

Keywords: *climate change, ecological problems, eco-anxiety, environmental behavior, scale adaptation.*

1. Introduction

Climate change is a catastrophic global phenomenon referring to long-term changes in temperature and weather patterns mainly due to human activities (United Nations, n. d.). The World Health Organization (2021) predicted climate change would result in an extra 250,000 deaths per year between 2030 and 2050 due to malnutrition, malaria, diarrhea, and heat stress. These predictions have made climate change one of the most critical global health threats of the 21st century. In addition to endangering physical health, ecological problems including climate change have begun to put the mental health of individuals at risk (Bourque & Willox, 2014). Recently, the impact of climate change on mental health has received considerable attention. In this context, Albrecht (2011, p. 43) defined "psychoterratic syndromes" as negative emotions related to changing environments that individuals experience. One of these psychoterratic syndromes is called eco-anxiety, referring to anxiety stemming from ecological problems, and their prospective consequences (Albrecht, 2011). Although researchers have proposed various definitions of eco-anxiety, Clayton, Manning, Speiser, and Hill (2021, p. 71) defined eco-anxiety as "a chronic fear of environmental doom.". An important point to consider is that eco-anxiety should not be pathologized (Clayton & Karazsia, 2020) since it is not a mental health disorder (Pihkala, 2020). Hogg, Stanley, O'Brien, Wilson, and Watsford (2021, p. 2) regarded eco-anxiety as a "rational reaction to the enormity of the ecological threat humanity and the planet is facing.". Still, many individuals have been distressed just by being aware of global climate change, even if they are not directly or indirectly affected by it (Pihkala, 2018). If the anxiety regarding ecological problems results in pro-environmental behaviors (PEB) and climate actions (Pavani, Nicolas, & Bonetto, 2023), it can be considered adaptive; however, it may also disrupt individuals' well-being and engagement in pro-climate behaviors (Stanley, Hogg, Leviston, & Walker, 2021). For instance,

while habitual worry about global warming was positively associated with PEB (Verplanken, Marks, & Dobromir, 2020; Verplanken & Roy, 2013), higher eco-anxiety predicted lower PEB and well-being (Stanley et al., 2021). When individuals with high eco-anxiety were compared to those with low eco-anxiety, the positive association between eco-anxiety and PEB was smaller in the former group (Heeren, Mouguiama-Daouda, & Contreras, 2022). All these findings may suggest that while low-to-moderate levels of eco-anxiety are essential and required to take ecological problems seriously and engage in PEB, excessive eco-anxiety may be dysfunctional and hinder pro-climate behaviors. Furthermore, previous studies showed that perceived ecological stress and climate change anxiety were moderately associated with depressive symptoms (Helm, Pollitt, Barnett, Curran, & Craig, 2018) and anxiety (Clayton & Karazsia, 2020). In their study, Clayton and Karazsia (2020) found that about 20% of the participants reported having cognitive or functional impairment due to climate change anxiety. Some individuals have started seeking psychotherapy for emotional problems related to climate change (Budziszewska & Jonsson, 2022).

Although researchers have measured the psychological impacts of climate change using different tools for at least a decade (Eisenman, McCaffrey, Donatello, & Marshal, 2015; Homburg, Stolberg, & Wagner, 2007; Reser, Bradley, & Ellul, 2012; Searle & Gow, 2010), there are few self-report questionnaires specifically developed to measure eco-anxiety (Clayton & Karazsia, 2020; Stewart, 2021). Hogg et al. (2021) developed the Hogg Eco-anxiety Scale (HEAS-13), a multidimensional tool with four factors assessing anxiety in relation to global environmental problems. The HEAS-13 had good validity and reliability, making the scale a valuable tool for research and clinical practice (Hogg et al., 2021). Until now, the HEAS-13 was adapted to Turkish (Uzun et al., 2022) and Portuguese (Sampaio et al., 2023). In both studies, a four-factor structure was found for the

HEAS-13. Although Uzun et al. (2022) adapted the HEAS-13 into Turkish, the adaptation study had several limitations, such as conducting exploratory and confirmatory factor analyses on the same sample (Fokkema & Greiff, 2017), choosing principal component analysis over factor analysis (Costello & Osborne, 2005), limited reporting of participants' demographics, and the absence of concurrent and incremental validity, and test-retest reliability assessments. Therefore, the present study aimed to re-adapt the HEAS-13 to Turkish independently and evaluate its psychometric properties by compensating for the limitations of previous adaptation in non-clinical Turkish samples. In the current study, we examined the concurrent and incremental validity of the HEAS-13 as well as the three-week test-retest reliability. Regarding concurrent validity, it was expected that the HEAS-13 would have medium to high correlations with climate change worry since both tools measure very similar constructs. Moreover, it was expected that there would be small to medium correlations with PEB, activist identity and commitment (AIC), depression, anxiety, and stress. Previous studies showed that eco-anxiety was related to PEB (Heeren et al., 2022) and AIC (Pahl, Harris, Todd, & Rutter, 2005), and psychological symptoms (Hogg et al., 2021). Finally, it was examined whether eco-anxiety can explain additional variance in PEB beyond AIC because it was found that environmental identity was a significant predictor of environmental strivings (Kashima, Paladino, & Margetts, 2014).

2. Method

2.1 Participants

A total of 605 individuals, recruited via online platforms, participated in the study. Exploratory and confirmatory factor analyses were carried out separately in randomly split samples (Fokkema

& Greiff, 2017). Concurrent and incremental validity were tested in the total sample. Moreover, a third separate sample was used to evaluate test-retest reliability. The demographic characteristics of the samples are presented in Table 1.

-----TABLE1-----

2.2 Instruments

2.2.1 Hogg Eco-Anxiety Scale (HEAS-13)

The HEAS-13 is an eco-anxiety scale with 13 items developed by Hogg et al. (2021) to measure anxiety in response to the global environmental crisis with four subscales: affective symptoms, rumination, behavioral symptoms, and anxiety about one's personal impact. Items are rated on a 4-point Likert-type scale, ranging from 0 (not at all) to 3 points (nearly every day). All subscales of the HEAS-13 had satisfactory internal consistency coefficients (αrange = .88-.92) (Hogg et al., 2021).

2.2.2 Climate Change Worry Scale (CCWS)

Stewart (2021) developed the CCWS to measure the level of worry individuals experience regarding climate change. The CCWS has a single-factor structure having ten items. Higher scores indicate higher levels of worry about climate change. The Turkish adaptation study of the scale was conducted by Ozbay and Alcı (2021), and Cronbach's Alpha coefficient was reported as .98.

2.2.3 Activist Identity and Commitment Scale (AICS)

The AICS is an 8-item single-factor scale developed by Klar and Kasser (2009) to measure AIC to activism. Higher scores indicate higher AIC. Cengiz and Günay (2020) adapted the AICS to Turkish, and they reported an internal consistency coefficient score of .98.

2.2.4 Depression Anxiety Stress Scale-21 (DASS-21)

Lovibond and Lovibond (1995) developed the DASS-21 to measure depression, anxiety, and stress severity. The scale had three factors and 21 items. Higher scores indicate higher severity of symptoms. Yıldırım, Boysan, and Kefeli (2018) adapted the DASS-21 to Turkish. The Turkish DASS-21 had good internal consistency coefficients for depression (DASS-D, .89), anxiety (DASS-A, .87), and stress (DASS-S, .90) subscales (Yıldırım et al., 2018).

2.2.5 Environmental Behavior Scale (EBS)

Goldman, Yavetz, and Pe'er (2006) developed the 20-item EBS to measure the level of PEB to what extent individuals perform environmentally related activities. Higher scores on the scale indicate a higher frequency of PEB. The Turkish adaptation study of EBS was conducted by Timur and Yılmaz (2013), and the original factor structure was confirmed. The internal consistency coefficient of the total scale was .85 (Timur & Yılmaz, 2013).

2.3 Procedure

The current research obtained its ethical approval from Middle East Technical University's Human Subjects Ethics Committee. The process of scale adaptation was conducted in accordance with

International Test Commission guidelines, and a double-translation and reconciliation procedure was utilized in the adaptation process (International Test Commission, 2017). The first (KKT) and third authors (JCY) translated the scales into Turkish, and the second author (EDK) merged the translations into a single form. Then, a pilot study with 21 individuals was carried out to explore the clarity of the translated guidelines and items. The final version of the form was created based on the results of the pilot study. All measures were presented to the participants via the Qualtrics Survey System in counterbalanced order. Participants were given informed consent explaining the aim of the study, confidentiality, and their right to quit the survey at any time. Participation in the study took approximately 20 min. To assess test-retest reliability, a separate sample of 83 participants who did not participate in the main study completed the HEAS-13 twice at 3-week intervals via the Qualtrics Survey System. As in the main study, all participants were informed about the purpose of the study, confidentiality, and their rights. This part took approximately 2 min to be completed by the participants.

2.4 Statistical Analysis

The data analyses were conducted in SPSS 25 and JASP 0.17.2. The summary of statistical analyses to examine the psychometric properties of the HEAS-13 can be seen in Table 2. Pearson correlations between the HEAS-13, DASS-21, and CCWS were used to assess concurrent validity, and a hierarchical multiple regression with the AICS and EBS was conducted to examine the incremental validity of the HEAS-13.

-----TABLE2-----

3. Results

3.1 Exploratory Factor Analysis

The latent dimensionality of the HEAS-13 was assessed with exploratory factor analysis (EFA) in the first sample. Using Mahalanobis distance, nine outliers were identified and excluded from further analysis. The final sample consisted of 294 participants. The majority of the correlations between the items of the HEAS-13 were between .30 and .80. Appropriateness of data for EFA was indicated by the Kaiser-Meyer Olkin (KMO) test of sample adequacy (.93) and the Bartlett test of sphericity ($\chi 2$ (78) = 2728.06, $p < .001$). Due to the violation of multivariate normality (Mardia's $Z = 17.36$, $p < .001$) and expected correlations between the factors of the scale (Costello & Osborne, 2005), EFA was carried out using parallel analysis with principal axis factoring estimation and oblique-oblimin rotation. As expected by the theory, parallel analysis and scree plot yielded a four-factor structure. The factor loadings of all items were above the threshold value of .40 (.58-.92). The four-factor structure accounted for 70.30% of the variance. Table 3 summarizes the factor structure of the Turkish HEAS-13. The results indicated that the factor structure of the Turkish HEAS-13 was identical to that of the original study.

-----TABLE3-----

3.2 Confirmatory Factor Analyses

Confirmatory factor analyses (CFA) were carried out in the second sample to assess two models: one-factor and four-factor structures of the HEAS-13. There were 13 outliers detected by Mahalanobis distance. After the removal of outliers, the final sample consisted of 289 participants.

CFA was carried out with maximum likelihood parameter estimates, Satorra-Bentler correction, and robust error calculation because the multivariate normality assumption of CFA was violated (Mardia's $Z = 18.10$, $p < .001$). One-factor and four-factor models with 13 items were constructed. The results of the goodness-of-fit indices yielded that the four-factor model fit the data well ($\chi 2$ (59) = 103.52, $p < .001$, SRMR = .04, RMSEA = .05, 90% CI = [.03, .07], TLI = .98, CFI = .98) but one-factor model had poor it ($\chi 2$ (65) = 497.97, $p < .001$, SRMR = .07, RMSEA = .15, 90% CI = [.14, .16], TLI = .80, CFI = .83). The path diagram for the four-factor structure of Turkish HEAS-13 can be seen in Fig. 1. The results validated the four-factor structure of the Turkish HEAS-13.

-----FIGURE1-----

3.3 Concurrent Validity

Pearson correlations between the HEAS-13, CCWS, EBS, AICS, and DASS-21 in the total sample (N = 605) were presented in Table 4 and indicated small to strong associations among the measures, supporting the concurrent validity of the HEAS-13.

-----TABLE4-----

3.4 Incremental Validity

A hierarchical multiple regression in the total sample was conducted to assess whether the dimensions of HEAS-13 can explain extra variance in PEB beyond AIC. Four outliers, identified

using Mahalanobis distance, were removed from further analysis, and the final sample consisted of 601 participants. Anxiety symptoms, rumination, behavioral symptoms, anxiety about the personal impact, and AIC were entered as predictor variables to predict PEB. Anxiety symptoms and behavioral symptoms explained an additional 6.60% variance in PEB after controlling AIC. The details of hierarchical multiple regression can be seen in Table 5. The results provided support for the incremental validity of anxiety and behavioral symptoms in predicting PEB beyond AIC. Additional analysis regarding eco-anxiety dimensions predicting PEB can be seen in Supplementary Materials – B.

-----TABLE5-----

3.5 Internal Consistency and Test-Retest Reliability

The Cronbach's alpha coefficients and intra-class correlation coefficients between the baseline and three-week follow-up scores of the HEAS-13 can be seen in Table 4. The result of the reliability analyses suggested that the Turkish HEAS-13 had good internal consistency and mediocre test-retest reliability.

3.6 Eco-Anxiety Scores Depending on Age Groups, Gender, Reproductive Attitudes, and Diet Type

Additional analyses regarding the differences in eco-anxiety scores depending on age groups, gender, reproductive attitudes, and diet type can be seen in Supplementary Materials B.

4. Discussion

The aim of the present study was to contribute to the investigation of the psychometric properties of the HEAS-13 in Turkey, together with Uzun et al.'s study (2022). The results of EFA and CFA found and validated a four-factor structure with 13 items, and supported the fourfactor structure of the HEAS-13 also reported in the original study (Hogg et al., 2021), previous Turkish (Uzun et al., 2022) and Portuguese (Sampaio et al., 2023) adaptations. These findings suggest that HEAS-13 dimensions may be conceptually robust across countries (Hogg, Stanley, & O'Brien, 2023), though further testing of the HEAS-13 is certainly needed. The use of standardized eco-anxiety measures (such as HEAS-13) having measurement invariance will (1) allow the comparison of cross-cultural differences between the eco-anxiety experiences of individuals from different cultural contexts, (2) help us understand the effects of eco-anxiety on mental health locally and globally, and (3) direct us in efforts to facilitate individuals' engagements in PEB and climate action.

The correlational results also showed moderate to strong associations between the HEAS-13 dimensions and the CCWS (r_{range} = .31-.57, $p < .001$). These findings were expected since both measures were developed to assess related constructs. The small to moderate correlations between the HEAS-13 and depression, anxiety, and stress indicated that eco-anxiety is moderately related to negative mental health symptoms but also stands as a separate construct (Hogg et al., 2021). Similarly, there were significant moderate correlations between the HEAS-13 and both PEB and AIC. The factor of anxiety symptoms was the most strongly related to PEB and was a significant predictor of PEB in hierarchical regression analysis along with behavioral symptoms and AIC, meaning that higher anxiety symptoms predicted higher PEB. Evidence from several studies showed that negative emotions, which signal the endangerment of significant values, were

significant predictors of pro-climate behaviors (Brosch, 2021; Stanley et al., 2021; Steg, 2023). Moreover, emotions (e.g., guilt) elicited by not engaging in pro-climate behaviors may also increase the likelihood of pro-climate behaviors (Hurst & Sintov, 2022; Rees, Klug, & Bamberg, 2015). Contrary to anxiety symptoms, lower behavioral symptoms predicted higher PEB. The contents of the items of behavioral symptoms, which comprise sleep difficulties, an inability to enjoy social situations, and difficulties in working and studying, suggest that higher severity of behavioral symptoms may impair daily functioning and, as expected by Hogg et al. (2021), may prevent engaging in PEB. This finding also may indicate that interventions aiming to increase PEB should focus more on alleviating behavioral symptoms rather than anxiety symptoms. Because non-paralyzing levels of anxiety symptoms in relation to environmental problems may be rational (Hogg et al., 2021) in terms of taking ecological threats seriously. Moreover, the results of hierarchical regression analysis suggested that AIC was a significant predictor of PEB. This came as no surprise since collective identities such as being an activist are regarded as important determinants of individuals' behaviors via processes of "group norms and social influence, collective efficacy, and collective emotions" (Mackay, Schmitt, Lutz, & Mendel, 2021, p. 95). Therefore, interventions or programs enhancing one's sense of AIC may lead to higher levels of PEB (Fielding, McDonald, & Louis, 2008).

As in the original study, the HEAS-13 had internal consistency coefficients higher than .82, indicating good internal reliability. The testretest reliability of the HEAS-13 was evaluated with intra-class correlations between the baseline and three-week follow-up scores. The intra-class correlations of the subscales, except behavioral symptoms, were above the threshold value of .50, indicating moderate reliability (Koo & Li, 2016). Similar to the findings of the original study

(Hogg, Stanley, O'Brien, Wilson, and Watsford, 2023), these results showed that behavioral symptoms were less stable over time compared to other eco-anxiety dimensions. A possible explanation for the low stability of behavioral symptoms may be that behavioral symptoms are more sensitive to external factors, such as exposure to catastrophic climate events and climate information than other dimensions of eco-anxiety.

Some limitations of the current study should be acknowledged. First, our samples consisted of mostly young female university students, which limits the generalizability of the findings. As suggested by Hogg et al. (2021), the eco-anxiety experiences of younger individuals may be an intriguing subject of interest since the negative outcomes of the climate crisis will influence their lives more profoundly than the lives of older individuals. Therefore, future research with more representative samples and assessment of gender and age invariances of Turkish HEAS-13 is strongly recommended. In addition, employing qualitative methods to investigate the difference between the eco-anxiety experiences of younger and older individuals may provide valuable insights. Second, the design of the current study was cross-sectional. Future studies should utilize experimental and longitudinal methods to investigate the causal relationship between the variables of the current study. Finally, the mean score of the HEAS-13 in our sample indicated that the participants reported mild eco-anxiety, as found in the original study (Hogg et al., 2021). This limits the generalizability of the findings to individuals with high levels of eco-anxiety. There could be several explanations for the findings. First, it is probable that levels of eco-anxiety experienced by the participants can be affected by the amount of climate information to which individuals are directly or indirectly exposed (Whitmarsh et al., 2022), meaning that low levels of eco-anxiety may be a result of low exposure to catastrophic climate events and climate information

before or during the measurement of eco-anxiety. Second, the low levels of eco-anxiety could be due to a possible relationship between eco-anxiety and mortality salience, as highlighted by the literature (Pikhala, 2022). Terror management theory posits that awareness of mortality triggers proximal (attempts to eliminate death thoughts from consciousness in the short-term) and distal (provides a long-term buffer against awareness of death) defense mechanisms (Pyszczynski, Solomon, & Greenberg, 2015). Measuring eco-anxiety with explicit self-report tools may lead to under-reporting of eco-anxiety since the awareness of ecological threats and environmental doom (evident in the instruction of the HEAS-13) may evoke mortality salience (Wolfe & Tubi, 2019) and activate proximal defenses, characterized by denial and repression, which can suppress reports of eco-anxiety (Abeyta, Juhl, & Routledge, 2014; Bassett, 2005). Therefore, future research can investigate the relationship between eco-anxiety and death anxiety, experimentally test whether awareness of ecological threats executes proximal or distal defense mechanisms as death anxiety does, and if so, develop implicit ways of measuring eco-anxiety.

It is recommended that future studies should assess configural invariance in other countries (having different cultures and levels of industrialization) and investigate metric and scalar invariances, to help further establish measurement invariance of the HEAS-13 across countries. In addition, more research is required to elucidate how eco-anxiety interacts with mental health or pro-climate behaviors in different populations and cultural settings since the impacts of ecological problems vary significantly among countries (Hogg, Stanley, & O'Brien, 2023), and cultural context may shape individuals' responses to eco-anxiety and ecological problems (Hornsey, 2021; Nartova-Bochaver et al., 2022).

Globally, the negative impact of environmental problems on individuals' lives is getting worse each day. The mental health of individuals is one of the most significantly affected, but recently discussed, areas by ecological problems. The use of standardized eco-anxiety measures (using scales like the HEAS-13) can enable us to understand the effects of ecological problems on mental health and provide us with valuable insights regarding individuals' engagement in PEB and climate actions, which can be used to enhance pro-climate behaviors. We hope that the use of Turkish HEAS-13 contributes to global evidence and efforts to understand eco-anxiety and related experiences.

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Tables

Table 1
Demographics of the Samples

	First Sample		Second Sample		Total Sample		Third Sample	
	M	*SD (Min-Max)*	*M*	*SD (Min-Max)*	*M*	*SD (Min-Max)*	*M*	*SD (Min-Max)*
Age	26.33	8.16 (18-68)	26.75	8.34(19-68)	26.54	8.25 (18-68)	21.29	3.68 (18-39)
	N	%	*N*	%	*N*	%	*N*	%
Gender								
Female	209	68.98	214	70.86	423	69.92	69	83.13
Male	94	31.02	88	29.14	182	30.08	14	16.87
Education								
High School	6	1.98	10	3.31	16	2.65	7	8.43
University	220	72.61	223	73.85	443	73.22	74	89.16
Master's degree	55	18.15	53	17.55	108	17.85	1	1.21
Ph.D.	22	7.26	16	5.30	38	6.28	1	1.21
Employment								
No	193	63.70	182	60.27	375	61.98	72	86.75
Yes	110	36.30	120	39.74	230	38.02	11	13.25
Marital Status								
Single	251	82.84	245	81.13	496	81.98	82	98.80
Married	48	15.84	49	16.23	97	16.03	1	1.21
Divorced	4	1.32	8	2.65	12	1.98	0	0
Socioeconomic Status								
Low	45	14.85	33	10.93	78	12.89	6	7.23
Low-Middle	64	21.12	68	22.52	132	21.82	16	19.28
Middle	140	46.21	143	47.35	283	46.78	51	61.45
Middle-High	48	15.84	55	18.21	103	17.03	10	12.05
High	6	1.98	3	0.99	9	1.49	0	0.00
Children								
No	271	89.44	270	89.40	541	89.42		
Yes	32	10.56	32	10.60	64	10.58		
Planning to have children								

(Children = No)						
No	127	46.86	127	47.04	254	46.95
Yes	144	53.14	143	52.96	287	53.05
Planning to have no children due to climate crisis (Planning to have no children = No)						
No	66	51.97	61	48.03	127	50.00
Yes	61	48.03	66	51.97	127	50.00
Diet Type						
Carnivore	6	1.98	3	.99	9	1.49
Omnivore	266	87.79	271	89.74	537	88.76
Vegetarian	21	6.93	18	5.96	39	6.45
Vegan	10	3.30	10	3.31	20	3.31
Reason to be vegetarian or vegan (Diet Type = Vegetarian or Vegan)						
Personal Health	13	22.03	10	16.95	23	38.98
Ecological Concerns	22	37.29	18	30.51	40	67.80
Animal Rights/Ethics	25	42.37	26	44.07	51	86.44
Other	5	8.47	1	1.69	6	10.17

Table 2
Analyses to examine psychometric properties of the Turkish HEAS-13

Validity	Analysis	Indicators
Construct validity	Exploratory Factor Analysis	Sample size ≥ 130 (Mundfrom, Shaw, & Ke, 2005) Item correlations between .30-.80 (Hair, Black, Babin, & Anderson, 2019) KMO value ≥ .90 (Watkins, 2020) Significant Bartlett test of sphericity (Watkins, 2020) Factor loading threshold ≥ .40 (Pituch & Stevens, 2015)
	Confirmatory Factor Analysis	Sample size ≥ 200 (Kyriazos, 2018) Insignificant $\chi 2$ test (Schumacker & Lomax, 2016) SRMR ≤ .05 (Schumacker & Lomax, 2016) RMSEA ≤ .08 (Schumacker & Lomax, 2016) TLI ≥ .90 (Schumacker & Lomax, 2016) CFI ≥ .90 (Schumacker & Lomax, 2016)
Concurrent validity	Pearson Correlation	Small to high significant correlations (Hughes, 2018)
Incremental validity	Hierarchical Regression	Significant explained variance beyond the control variable (Hughes, 2018)

Reliability	Analysis	Indicators
Internal consistency	Cronbach's Alpha	α ≥ .70 (Hoekstra, Vugteveen, Warrens, & Kruyen, 2019)
Test-retest reliability	ICC	Sample size ≥ 66 (Bujang & Baharum, 2017) ICC ≥ .50 for moderate reliability (Koo & Li, 2016)

Table 3
The dimensionality of the Turkish version of HEAS-13

	Factor			
	Affective symptoms	Rumination	Behavioral symptoms	Anxiety about the personal impact
Feeling nervous, anxious, or on edge	.58			
Not being able to stop or control worrying	.62			
Worrying too much	.82			
Feeling afraid	.70			
Unable to stop thinking about future climate change and other global environmental problems		.85		
Unable to stop thinking about past events related to climate change		.86		
Unable to stop thinking about losses to the environment		.69		
Difficulty sleeping			.64	
Difficulty enjoying social situations with family and friends			.74	
Difficulty working and/or studying			.73	
Feeling anxious about the impact of your personal behaviors on the earth				.79
Feeling anxious about your personal responsibility to help address environmental problems				.92
Feeling anxious that your personal behaviors will do little to help fix the problem				.67
% of Explained Variance	19.50	18.80	14.20	17.80

Note. Bold characters show items loaded to factors in respective columns.

Table 4

The correlations between HEAS-13, CCWS, EAESS, AICS, and DASS, descriptive statistics, and internal consistency coefficients, and intra-class correlations of HEAS-13

	1	2	3	4	5	6	7	8	9	10
1) HEAS-AS	-									
2) HEAS-R	.75 **	-								
3) HEAS-BS	.62 **	.55 **	-							
4) HEAS-AAPI	.66 **	.65 **	.46 **	-						
5) CCWS	.56 **	.57 **	.31 **	.54 **	-					
6) EBS	.36 **	.35 **	.20 **	.32 **	.47 **	-				
7) AICS	.32 **	.34 **	.25 **	.32 **	.40 **	.45 **	-			
8) DASS-D	.27 **	.24 **	.27 **	.29 **	.18 **	.04	.04	-		
9) DASS-A	.37 **	.29 **	.34 **	.30 **	.22 **	.07	.10 *	.64 **	-	
10) DASS-S	.32 **	.28 **	.29 **	.31 **	.22 **	.06	.14 **	.78 **	.77 **	-
Mean	.83	.72	.45	1.06	2.93	3.30	3.11	1.26	.76	1.20
SD	.68	.71	.60	.80	.95	.58	1.43	.76	.60	.70
Min	.00	.00	.00	.00	1.00	1.60	1.00	.00	.00	.00
Max	3.00	3.00	2.67	3.00	5.00	4.90	6.88	3.00	3.00	3.00
Cronbach α	.88	.84	.82	.88	.94	.87	.95	.90	.84	.89
ICC	.53	.56	.47	.52	-	-	-	-	-	-

Note 1. *$p < .05$, ** $< .001$.

Note 2. HEAS-AS: Hogg Eco-Anxiety Scale Affective Symptoms Subscale, HEAS-R: Hogg Eco-Anxiety Scale Rumination Subscale, HEAS-BS: Hogg Eco-Anxiety Scale Behavioral Symptoms Subscale, HEAS-AAPI: Hogg Eco-Anxiety Scale Anxiety about Personal Impact Subscale, CCWS: Climate Change Worry Scale, EBS: Environmental Behavior Scale, AICS: Activist Identity and Commitment Scale, DASS-D: Depression Anxiety Stress Scale Depression Subscale, DASS-A: Depression Anxiety Stress Scale Anxiety Subscale, DASS-S: Depression Anxiety Stress Scale Stress Subscale.

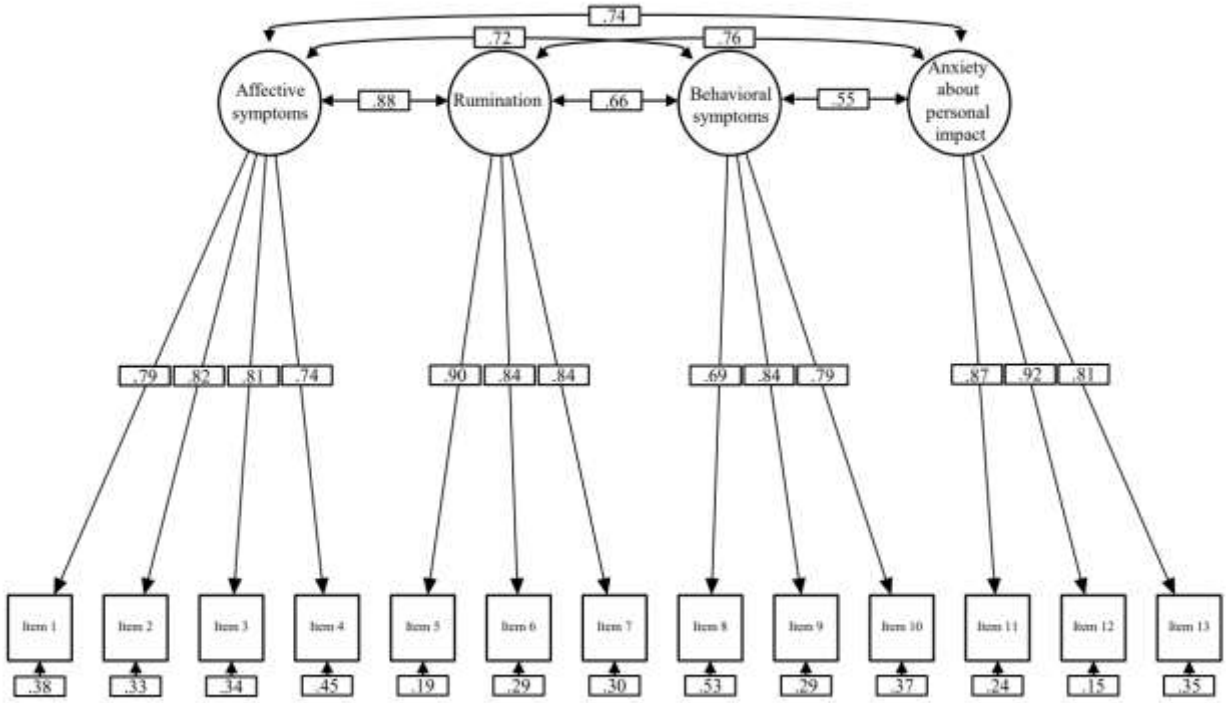
Note 3. ICCs were calculated with a two-way mixed model, absolute agreement, and single-measure settings.

Table 5
The results of hierarchical regression analysis for the HEAS-13 and activist identity and commitment predicting pro-environmental behavior

								Collinearity Statistics	
Model		*F* (df_1, df_2)	Adjusted R^2	B	SE	β	t	p	Tolerance	VIF
Step 1		147.96(1, 599)	.20					< .001		
	Intercept			54.72	1.02		53.56	< .001		
	Activist identity and commitment			.46	.04	.45	12.16	< .001	1.00	1.00
Step 2		42.62 (5,595)	.26					< .001		
	Intercept			49.03	1.41		34.78	< .001		
	Activist identity and commitment			.36	.04	.35	9.32	< .001	.86	1.16
	Anxiety symptoms			.92	.27	.21	3.44	< .001	.33	3.03
	Rumination			.46	.32	.08	1.42	.157	.36	2.80
	Behavioral symptoms			-.69	.31	-.10	-2.24	.026	.58	1.71
	Anxiety about personal impact			.31	.24	.06	1.28	.200	.51	1.98

Figures

Figure 1
The four-factor model of Turkish HEAS-13



Note. All reported estimates are standardized and significant at the level of .001.