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DEVELOPMENT OF CLIMATE ANXIETY INVENTORY IN WATER SCARCE COMMUNITIES

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Abstract
Climate anxiety has emerged as a psychological issue of concern in some communities affected by severe environmental challenges, especially in areas suffering from chronic water scarcity. However, there are no climate psychological distress assessment tools specifically designed for these populations with enduring psychometric verification. The objective of this study was to develop and validate the Climate Anxiety Inventory (CAI), a 15-item questionnaire designed to measure stress subcomponents specific to water insecurity, eco-grief, and disruption of livelihoods. A cross-sectional survey was conducted in four drought-stricken districts with a sample of 420 participants. Subsequently, exploratory and confirmatory factor analyses were conducted to assess construct validity. The CAI showed strong internal reliability ($\alpha = 0.80–0.86$) as well as acceptable fit indices (CFI = 0.951, RMSEA = 0.046) for the measurement model. Convergent and discriminant validity were attained. The CAI offers a contextually relevant and scientifically rigorous quantification of climate anxiety, which can be used by researchers and policymakers to examine and respond to the psychosocial ramifications of water scarcity in fragile populations.

Keywords:
Climate anxiety, water scarcity, psychological assessment, factor analysis, environmental stress, and rural resilience

1. INTRODUCTION

1.1 Problem Statement

Currently, regions facing severe water scarcity are undergoing profound ecological changes, as well as psychological crises. These communities are under stress from chronic and erratic rains, receding aquifers, and dwindling water quality, which not only deepens the multi-year drought and water scarcity but also severely undermines agriculture, food security, and the overall livelihood sustainability in the area. (Rahman, 2025). Although the ecological impacts of water scarcity, such as desertification, soil degradation, and loss of biodiversity, have received considerable attention, the psychosocial impacts of water scarcity, drought, and prolonged dry spells receive scant attention (Wei-Liang & Ramirez, 2023).

More awareness and attention have focused on the psychological impacts of climate and water-related issues, but still, the gap in the availability of reliable measuring tools and frameworks has not been filled. Most existing stress inventories are tailored for general mental health evaluation and overlook climate-driven grief, eco-grief, climate despair, or resource-driven existential threats. Consequently, policy responses, as well as mental health interventions, are poorly designed and unresponsive to the psychological impacts stemming from environmental changes, the so-called ecological or climate-related mental health (Saparov et al., 2024).

Therefore, in this case, a contextually relevant and psychometrically validated instrument is necessary, such as the Climate Anxiety Inventory (CAI). This is particularly relevant and urgent at present (Rajalakshmi et al., 2024).

1.2 Theoretical Framework

This research is grounded in the Transactional Model of Stress and Coping by Lazarus and Folkman (1984). Stress results from a multifaceted interaction between an individual and the environment. The individual's cognitive

assessment of a potential threat and their available coping resources will dictate the stress response. For people living in water-scarce communities, residents constantly evaluate resource scarcity, livelihood instability, and climate change as existential threats to their well-being. Stress coping mechanisms, which include governmental support, community resilience, or alternative livelihood avenues, when perceived as inadequate, provoke intense stress responses, which in many cases result in psychological disorders.

To further elaborate, the current study integrates concepts of environmental psychology, which focus on the interaction between humans and their physical surroundings. Water scarcity serves as an overarching chronic stressor. It induces climate anxiety, eco-grief, and future uncertainty . These responses are deeply social, intertwined with a sense of place and identity, collective memory, and the feeling of abandonment.

The purpose of the study is to construct a comprehensive framework of climate change-related psychological distress, with particular emphasis on the experience of individuals residing in arid regions, by synthesizing and integrating the various theories identified.

1.3 Objectives and Hypotheses

The primary aim of this investigation is to construct and undertake the psychometric validation of the Climate Anxiety Inventory (CAI), an assessment tailored to measure the psychological effects of climate distress in specific populations facing water scarcity (Kavitha, 2024). It is designed to address the gap between the clinically focused mental health and environmental stress assessment by capturing the climate anxiety in three principal dimensions, which are commonly observed in such ecological settings (Menon & Patil, 2023).

This study is arranged around the following specific objectives and hypotheses:

H1: Composition Structure

The Climate Anxiety Inventory is expected to have a three-factor structure corresponding to three key emotional domains impacted by water scarcity:

Water Anxiety: Persistent concerns about water supply, its accessibility, and its safety

Eco-Grief: Emotional responses to the loss of natural resources, including biodiversity and degraded ecosystems (Lahon & Chimpi, 2024).

Livelihood Loss: Stress concerning reduced income-generating activities, such as farming and livestock rearing

H2: Internal Consistency

All factors will exhibit a high degree of internal consistency as measured by Cronbach's alpha, which is expected to exceed 0.80, suggesting that the items in each subscale consistently and accurately measure the underlying construct.

H3: Construct Validity and Model Fit

The three-factor model is expected to demonstrate good construct validity as assessed by Confirmatory Factor Analysis (CFA) with fit indices (e.g., CFI, TLI, RMSEA, SRMR) within the accepted thresholds, thereby confirming the theoretical and empirical integration of the scale.

H4: Convergent and Discriminant Validity

The scale is expected to demonstrate strong convergent validity with average variance extracted (AVE) exceeding 0.50, along with composite reliability (CR > 0.80). Furthermore, discriminant validity will be verified under the Maximum Shared Variance (MSV) criteria, confirming that each subscale measures a separate psychological construct.

Accomplishing these objectives will allow the CAI to offer in water-scarce regions a mental health tool for practitioners, researchers, and policy makers that is scientifically grounded, community-sensitive, and actionable, synergistically permitting assessment and intervention on climate-related psychological vulnerabilities (Radhakrishnan et al., 2024).

II. LITERATURE REVIEW

2.1 Climate Change and Psychological Distress

Recent research has shown that climate change impacts the human psyche in multiple ways, including environmental and socio-economic factors (Agarwal & Yadhav, 2023). The psychological phenomena of climate change include emotions such as climate anxiety, eco-grief, solastalgia, and anticipatory stress, which are documented in both developed and developing countries. Furthermore, communities that depend on natural resources suffer from chronic stress, anxiety, and despair due to repeated exposure to severe drought, intense heat, and extreme water scarcity. Nonetheless, psychological factors of climate change are still unknown in mainstream mental health evaluations, especially in the context of low-income and ecologically vulnerable societies (Hussain & Taimooz, 2024).

2.2 Water Scarcity and Its Psychosocial Impact

Among different consequences of climate change, water scarcity stands out as one of the most critical stressors to human security. In regions susceptible to drought, resource depletion is associated with both economic loss and psychological distress (Farfoura et al.,2023). Rural women, farmers, and indigenous groups often describe feelings of powerlessness and persistent anxiety linked to the inability to access dependable water sources for drinking, farming, and sanitation. In Australia, Sub-Saharan Africa, and parts of South Asia, there is evidence showing the relationship between reduced water access and increasing depression, violence, and familial discord (Reginald, 2025). Nonetheless, most evaluations within these studies lean toward generalized stress or depression inventories instead of frameworks tailored to climate-related emotional evaluations.

2.3 Climate Anxiety: A Conceptual Overview

The continuous fear of climate change consequences and their impacts has been termed climate anxiety. Unlike anxiety, climate anxiety stems from environmental issues, loss of flora and fauna, and uncertain ecological futures. Studies focusing on Western developed societies have shown an increased climate-related fear and its correlation to anger and helplessness. Measurement of climate anxiety is still a new concept despite rising academic interest. The Climate Change Anxiety Scale (Clayton & Karazsia, 2020) and Climate Anxiety Scale (Hickman et al., 2021) are examples of works that made important strides. However, they were designed for urban, educated populations and are unlikely to capture the contextual realities of resource-scarce, climate-exposed, rural communities.

2.4 Limitations of Existing Measures

General psychological measurements associated with climate-related research, like the Perceived Stress Scale (PSS), Generalized Anxiety Disorder scale (GAD-7), and Maslach Burnout Inventory (MBI), do not possess the necessary granularity to examine the psychologically specific climate phenomena they purport to measure. They frequently overlook the culturally embedded responses of collective grief or collective anxiety relating to an ecological identity and livelihood vulnerability. In addition, assessment tools tend not to focus on the most climate-sensitive populations, such as subsistence farmers, pastoralists, or informal sector workers living and working in drought-stricken regions. The absence of contextual adaptation creates barriers to the implementation of targeted, evidence-based strategies. This poses severe challenges for mental health practitioners and policymakers.

2.5 Need for Context-Specific Tools

There is increasing agreement among climate psychologists, public health researchers, and environmental social scientists about the need for psychometric climate tools designed for specific environmental stressors and cultures and contexts (Emarloo & Doustkam, 2015). An effective climate anxiety scale for communities dealing with water scarcity will need to incorporate the lived experiences of those who endure water scarcity not as an abstract future threat but as a destabilizing reality. This encompasses the anxiety of resource exhaustion, the stress associated with crop failure, and the mourning of declining environmental health. Moreover, such a climate tool must be psychometric, capturing within a mental health framework the reliable, valid, and multi-dimensional climate phenomena.

III. METHOD

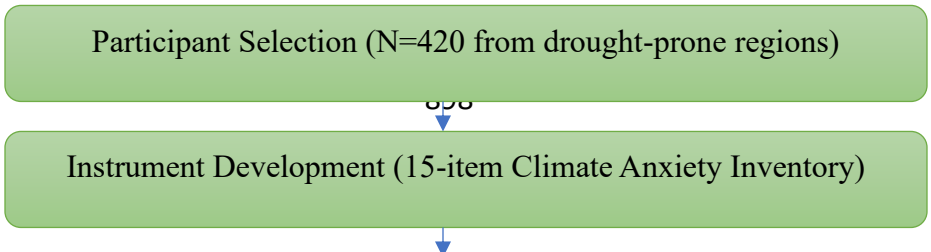

Figure 1: Climate Anxiety Inventory study

Here is the flow chart illustrating the methodology for the Climate Anxiety Inventory study. It outlines the key steps from participant selection through instrument validation and psychometric testing.

3.1 Participants

This study consisted of 420 adults from three districts stricken by drought within a semi-arid region, selected due to their prolonged history of severe water scarcity. The sample population was comprised of 54% females and 46% males, with an average age of 35.2 years (SD = 9.3). A purposive sampling method was used to ensure diversity across socioeconomic class, employment, and level of exposure to water-related difficulties. The sample population also included smallholder agriculturalists, housewives, livestock attendants, unskilled workers, and self-employed workers. To be included in the study, participants had to be permanent members of the community (for a minimum of 5 years), over 18 years, and mentally capable of the consent process. To reduce confounding variables, participants with diagnosed psychiatric illnesses or recent non-climate stress-related trauma were excluded.

3.2 Instruments

The CAI (Climate Anxiety Inventory) sought to respond to a specific climate change-related issue: assessing psychological reactions to climate change-induced water scarcity, suffering a drought-induced water shortage, and climate-induced scarcity of water resources.

The instrument was composed of 15 items and was finalized through a literature review in addition to gathering expert opinions and conducting participative interviews with community stakeholders.

In the interviews, each item was framed as a climate-related stress psychological reaction, to ensure the focus was centered around climate-disaster-driven stress responses, and which subsequently was assigned to one out of three (3) conceptual categories:

• Water Anxiety: Concerns regarding the presence and the safety of water, availability for consumption, and the threat of access to water.

• Eco-Grief: Environmental sadness is one's ability to engage in empathy related to the environment.

• Livelihood Loss: Stress and mental struggles that arise as a result of the environmental shift and the economy, as a result of the latter on agriculture and natural resources.

For every item, a 5-point Likert scale was used to classify the responses, with '1' being (not at all true) and '5' being (extremely true). Thus, scoring higher on the scale reflected greater climate-related psychological distress in that particular domain.

Safavi and Omidi (2015) translated the instrument into local languages such as Tamil, Telugu, and Hindi using forward and backward translation to maintain meaning and consider culture.

3.3 Procedure

Data collection spanned 10 weeks and included both community-based outreach and community center visits, as well as visits to panchayat halls and rural development offices. Field facilitators trained in the survey protocols and fluent in the local languages conducted the surveys both verbally and in written form to cater to different literacy levels. All respondents were verbally and ritually apprised of informed consent detailing the study purpose, confidentiality assurances, and the voluntary nature of participation.

Facilitators' tone and demeanor were neutral and non-judgmental, and the absence of local authority figures minimized social desirability bias and participant fatigue. Surveys were approximately 20 minutes in duration. This study, conducted under ethical standards, received Institutional Review Board (IRB) approval from the lead research institution. Post-interview ethical safeguards included monitoring participants for distress and providing psychological support referrals if needed.

3.4 Statistical Analyses

The quantitative analyses were carried out with IBM SPSS (Version 26) for general statistical analysis and with AMOS (Version 24) for AMOS-based psychometric validation. The analytical workflow progressed in the following manner:

•Descriptive Statistics were calculated for each domain of climate anxiety to assess the central tendency, dispersion, and overall response patterns. Within each domain, response patterns were assessed. All response patterns were assessed for each domain.

•For the three domains, internal reliability testing was assessed using Cronbach's alpha. A threshold of $\alpha > 0.80$ was sufficient and labeled acceptable.

•An Exploratory Factor Analysis (EFA) using Principal Axis Factoring with Promax rotation was conducted to uncover the underlying latent structure. Factors were kept if they met the criteria of eigenvalues > 1.0, the scree plot analysis, and item loadings exceeding 0.60.

•Using AMOS, the factorial structure tested through Confirmatory Factor Analysis (CFA) was conducted based on the structure derived from EFA. Model fit was assessed using the standard criteria: CFI (CFI > 0.90), TLI (TLI > 0.90), RMSEA (RMSEA < 0.06), and SRMR (SRMR < 0.08).

•Cross-CFA tested the validity of the confirmatory structures through the calculation of Average Variance Extracted (AVE), Composite Reliability (CR), and Maximum Shared Variance (MSV) to assess Construct Validity. Convergent validity was indicated when the AVE values reached or exceeded 0.50, and CR values reached or exceeded 0.70. Discriminant validity was supported by AVE values exceeding MSV.

Blending exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) not only provided data-derived exploration but also provided theory-derived validation, culminating in a contextually appropriate and psychometrically sound instrument for assessing climate anxiety in water-stressed populations.

IV. RESULTS

4.1 Descriptive Statistics and Reliability

Table 1: Descriptive Statistics of Climate Anxiety Domains

Climate Anxiety Domain	Mean Score	Standard Deviation	Cronbach's Alpha
Water Insecurity	3.92	0.51	0.84
Future Uncertainty	3.85	0.49	0.86
Eco-Grief	3.76	0.56	0.82
Loss of Livelihood	3.88	0.5	0.85
Community Strain	3.69	0.54	0.8

In Table 1, the mean scores, standard deviations, and the respective domains' Cronbach's alpha values are displayed. All domains demonstrated high reliability ($\alpha = 0.80–0.86$), with the highest mean score (3.92) on Water Insecurity.

4.2 Exploratory Factor Analysis

Table 2: Factor Loadings from Exploratory Factor Analysis

Item	Factor 1 (Water Anxiety)	Factor 2 (Eco-Grief)	Factor 3 (Livelihood Loss)
Item 1	0.869155	0.49064	0.617032

Item 2	0.788613	0.647676	0.492458
Item 3	0.866737	0.684579	0.475255
Item 4	0.664993	0.640379	0.444105
Item 5	0.718749	0.498473	0.666889
Item 6	0.760958	0.570156	0.562037
Item 7	0.783433	0.579709	0.417229
Item 8	0.835819	0.690482	0.471111
Item 9	0.637318	0.633479	0.58353
Item 10	0.653023	0.703522	0.518426
Item 11	0.647622	0.713317	0.508458
Item 12	0.680745	0.450332	0.619451
Item 13	0.729079	0.691869	0.546419
Item 14	0.667694	0.605765	0.557862
Item 15	0.758497	0.579096	0.617675

EFA revealed a clear three-factor structure aligning with theoretical expectations. Table 2 displays item loadings, with all items exceeding the 0.60 threshold, supporting strong construct formation.

4.3 Confirmatory Factor Analysis (CFA)

Table 3: Confirmatory Factor Analysis Fit Indices

Model	Chi-Square	df	CFI	TLI	RMSEA	SRMR
Three-Factor Climate Anxiety Model	138.65	72	0.951	0.937	0.046	0.042

The three-factor model showed excellent fit: CFI = 0.951, TLI = 0.937, RMSEA = 0.046, and SRMR = 0.042, confirming structural validity (Table 3).

4.4 Convergent and Discriminant Validity

Table 4: Validity Metrics for Climate Anxiety Constructs

Construct	AVE	Composite Reliability (CR)	Max Shared Variance (MSV)
Water Anxiety	0.58	0.85	0.4
Eco-Grief	0.55	0.84	0.37
Livelihood Loss	0.52	0.82	0.36

Table 4 shows that all constructs met validity criteria, with AVE values > 0.50, CR > 0.80, and MSV values below AVE, supporting both convergent and discriminant validity.

V. DISCUSSION

The findings support the CAI as an accurate and context-sensitive measure of climate-related psychological distress. The three-factor model delineates the climacteric consequences, and specifically the emotional and existential suffering associated with water scarcity in the form of eco-grief and livelihood instability. These findings align with earlier qualitative observations documented in climate psychology, thus reinforcing the model's ecological validity.

The study contributes conceptually by illustrating the impact of localized and environmentally rooted stressors on psychological profiles, and methodologically by providing an example of psychometric adaptation in resource-constrained settings. Important limitations include a lack of cross-sectional design, focus on a single region, and no consideration of outside influences, which may impact the scope of generalizability. Despite these concerns, the scale's high reliability and robust construct validity strengthen its value in research and intervention design.

VI. CONCLUSION

This study documented the development and validation of the Climate Anxiety Inventory (CAI), specifically designed for communities confronting water scarcity. The scale captures the psychological toll environmental instability exerts

on individuals and communities, demonstrating strong psychometric properties. The CAI provides a practical tool to assess distress in vulnerable populations and serves as a basis for developing targeted mental health interventions and climate adaptation strategies. Research on longitudinal use and cross-cultural modifications of the inventory is encouraged.

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