

Advances in Climate Change Psychology Research and Recommendations for Future Development: Postprint

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Abstract

Public perceptions, attitudes, emotions, and affective responses to climate change constitute important prerequisite factors for their engagement in climate change mitigation and adaptation. Tracking and monitoring public climate change psychology is of paramount importance for climate change education, mass media communication, and the formulation and implementation of climate policies. This article systematically discusses the mutual influences between climate change and public psychological reactions, organizes the multi-dimensional factors affecting climate change psychology, and proposes development recommendations from the perspective of the practical value of climate change psychology for climate governance, aiming to enhance the attention and application of public climate change psychology among psychological science, climate-related disciplines, and relevant government departments in China, thereby facilitating the construction of a climate-resilient society with universal participation.

Full Text

Progress and Development Suggestions for Psychological Research on Climate Change

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Abstract

Public psychological reactions to climate change—including cognition, attitudes, emotions, and affect—are critical antecedents to their participation in climate mitigation and adaptation efforts. Tracking and monitoring public climate psychology is therefore essential for effective climate change education, mass media communication, and climate policy formulation and implementation. This article systematically examines the mutual influences between climate change and public psychological responses, reviews multi-dimensional factors affecting climate psychology, and proposes development suggestions from the perspective of applying psychological insights to climate governance practice. The aim is to enhance attention and application of public climate psychology among Chinese psychologists, climate-related disciplines, and government departments, thereby facilitating the construction of a climate-resilient society with universal participation.

Keywords: climate change, psychology, mental health, mitigation and adaptation, climate policy

1. Impact of Climate Change on Mental Health and Coping Behavior

1.1 Climate Change Affects Mental Health Over the past two decades, the mental health impacts of climate change have received increasing research attention. Climate change-related disasters manifest in three forms: acute extreme weather events lasting several days (e.g., hurricanes, floods, wildfires, short-term heatwaves); sub-acute weather events lasting months or years (e.g., prolonged high temperatures or heatwaves and droughts); and long-term environmental changes extending to the end of the 21st century and beyond (e.g., rising temperatures, sea-level rise). Each form can cause varying degrees of loss, including property damage, reduced income and employment opportunities, diminished economic productivity, increased vector-borne and respiratory diseases, destruction of human attachment to natural environments, and social conflict and intergroup violence, ultimately exerting significant impacts on

mental health [7].

First, experiencing acute extreme weather events leads to psychological and psychiatric disorders. The incidence of anxiety and mood disorders increases with the frequency of extreme weather, triggering acute stress responses and post-traumatic stress disorder, reducing sleep quality, elevating suicidal ideation, and causing loss of self-awareness and identity due to displacement from homes [8]. The severity of mental health crises following acute events is exacerbated by factors including disaster severity, being female (relative to male), younger age, lower socioeconomic status, lower education level, ethnic minority status, prior psychiatric history, family instability, and insufficient social support [9]. Residents of low- and middle-income countries are particularly vulnerable to these consequences due to greater exposure to extreme weather events and extreme poverty that makes access to assistance services more difficult [10].

Second, sub-acute weather events lasting months or years threaten mental health. Research shows that longer heatwave durations have more destructive effects on mental wellbeing [11]. High temperatures inhibit thyroid hormone secretion [12], stimulate growth hormone and prolactin elevation [13], and cause dehydration [14], thereby impairing cognitive function—effects that are particularly severe for those with pre-existing serious mental disorders such as dementia and schizophrenia [15]. Long-term drought leads to food supply disruption and hindered economic development, causing psychological stress, generalized anxiety, and depression through destruction of community social structures [9], especially among indigenous peoples and residents of developing countries [16]. Children are particularly vulnerable to adverse mental health effects from long-term climate change due to physiological vulnerability, unique environmental interactions, and limited adaptive capacity [17].

Third, longer-term climate change-related events pose existential threats that make human responses seem insignificant, resulting in the most severe mental health consequences [7]. Concerns about future climate threats manifest as “climate anxiety” [18], also termed “eco-anxiety.” Large-scale multinational cohort studies indicate that public climate anxiety has a significant negative impact on subjective wellbeing [19] and is significantly associated with depressive and anxiety disorders [20], potentially causing panic, appetite loss, irritability, weakness, and insomnia in severe cases [8]. As a chronic stressor, climate anxiety is particularly prominent among children and young people [21]; climate change combined with perceived “government inaction” may cause long-term, progressive, and deep psychological damage to children and young people [22].

1.2 Climate Change Psychological Reactions Influence Individual Mitigation and Adaptation Climate change triggers a series of psychological reactions that subsequently influence individual coping behaviors. For instance, direct experience of climate-related extreme weather events such as floods, wildfires, and droughts enhances people’s climate change beliefs [23], risk perception [24-27], and worry [28], which in turn affect individual climate

adaptation behaviors [29].

Climate change cognition refers to subjective perception and evaluation of climate change realities, generally including: (1) belief in climate change—whether individuals perceive climate change as occurring [30]; (2) attribution of climate change—whether individuals attribute it primarily to natural or human causes [31]; (3) perceived impacts of climate change—whether individuals view impacts as positive or negative [32], or evaluate them by magnitude, establishing consensus that climate change threatens human survival and development, and assessing the degree of negative consequences for specific regions (global, national, or local), specific populations (self, family, foreigners), and specific time points (present or future) [33]; and (4) climate change risk perception—individual attitudes and perceptions toward climate change risk [34], primarily measuring cognitive representations of climate change risk in terms of imagery, catastrophic potential, and controllability to construct a climate change risk cognitive map.

Among climate change emotional reactions, the most studied are climate change worry [31] and climate change anxiety [18]. Climate change worry stems from individuals' persistent, repetitive, and uncontrollable cognitive processing of potentially catastrophic changes to the climate system [35] and is one of the most common emotional responses to climate change [31]. Unlike climate change concern, climate change worry is highly personalized and closely related to proactive action to reduce climate threats. Climate change anxiety is associated with climate change perception; individuals may experience climate change anxiety even without directly experiencing negative impacts, and due to climate change uncertainty, anxiety may be more prevalent than fear of climate change [18]. Additionally, various emotional reactions including hope, anger, guilt, sadness, interest, and disgust [31] have increasingly attracted researcher attention.

Mitigation and adaptation are internationally recognized as the two major strategies for addressing climate change. At the macro level, mitigation requires reducing greenhouse gas emissions and increasing carbon sinks in economic systems (energy, industry) and natural ecosystems, while adaptation requires risk management and identification-based adjustments in these systems to utilize favorable factors and guard against unfavorable ones, thereby reducing potential climate change risks. At the individual micro level, both mitigation and adaptation depend on broad public participation. The public must actively participate in low-carbon lifestyle transitions through energy conservation, green consumption, waste sorting, and green travel to mitigate climate change; they must also actively adapt through supporting climate adaptation policies, knowledge acquisition, purchasing insurance, and obtaining material and psychological assistance to enhance material and psychological resilience, reduce negative impacts, and increase positive ones [36]. Extensive research demonstrates that public cognition of and emotional reactions to climate change significantly influence personal participation in mitigation and adaptation behaviors.

Climate change psychological reactions affect public mitigation behaviors (e.g., low-carbon lifestyle transitions) in several ways. First, they influence individual

responsibility and morality. Individuals who attribute climate change primarily to human activity and consequently experience guilt and responsibility [38] are more willing to adopt low-carbon lifestyles, such as using public transportation, choosing high-efficiency appliances, and conserving energy [39]. Second, they influence normative consciousness. Perception of climate change risk helps enhance social norm identification for collective climate response, transforming climate change adaptation into a social norm [40], making the public more willing to participate in climate action. Third, they affect attention to climate information. Changes in attention direction toward climate information subsequently lead to attitude change and facilitate behavior change. Research shows that negative emotions about climate change [4] and high risk perception [42] are important factors influencing public attention to climate change information, and the acquired information can further enhance public understanding of climate change and urgency of response, thereby encouraging more low-carbon living patterns.

Climate change psychological reactions also affect public adaptation behaviors (e.g., enhancing material and psychological resilience). Extensive research indicates that attribution of climate change to human causes [43] and risk perception [44] can effectively increase public support for climate policies such as carbon taxes [45] and fossil fuel tax increases [46]. Through large-sample longitudinal surveys in China from 2020-2021, a team from the Institute of Psychology, Chinese Academy of Sciences analyzed factors influencing public support for carbon inclusive policies, finding that climate change perception has important explanatory power for carbon inclusive support [47]. Emotional reactions caused by climate change—including worry [43,48-50], interest, hope [44,51,52]—affect public support for climate public actions and policies. Public attention to and participation in environment and climate-related topics can also increase climate policy support [19]. A team from the Institute of Psychology, Chinese Academy of Sciences conducted a large-scale survey of 31 provincial-level administrative regions in China at the end of 2020, showing that public belief in climate change, attribution, perceived impact magnitude, and worry significantly increased attention to climate and environmental topics, leading to more active participation in climate change discussions, such as obtaining climate change information through various online and offline channels and disseminating it within interpersonal networks, which enables better understanding and implementation of climate policies or public climate actions [53].

2. Multi-Level Factors Influencing Climate Change Psychology

Climate change affects individual mental health and mitigation/adaptation behaviors through a process influenced by multi-level internal and external factors, resulting in differential and patterned psychological responses. The following sections elaborate on four levels.

2.1 Individual Characteristics Overall, women, young people [54,55], highly educated groups [27,32,56-59], and low-income individuals [24,25] show higher levels of climate change cognition and stronger emotional reactions. Notably, research conclusions on how gender and age affect climate change cognition are inconsistent [32], with some studies even finding that income has relatively small or no effect on climate change cognition [59].

Individual worldviews and values influence climate change psychological reactions. Ecological worldview reflects individuals' fundamental beliefs about nature's value and the human-nature relationship, affecting beliefs and attitudes toward more specific environmental issues [60], such as climate change risk perception [61]. Self-enhancement values motivate people to focus on self-interest, while self-transcendence values motivate them to look beyond self-interest, with the latter enhancing individuals' climate change beliefs, anthropogenic attribution, risk perception, and worry [62]. Worldviews and values influence climate change risk even more than general scientific literacy [63], making them highly salient in climate change psychology research.

Individual cognitive abilities affect climate change psychological reactions. On one hand, systems thinking—the cognitive understanding of systemic connections between human society, economy, and nature—directly influences climate change beliefs, anthropogenic attribution, risk perception, and worry levels [64]. On the other hand, individuals who self-identify as environmentally concerned [25] and capable of addressing climate change are more likely to perceive threats from climate change to national development and personal wellbeing [65], thereby eliciting higher levels of worry [66]. Additionally, greater trust in climate scientists, confidence in high scientific consensus on climate change, and belief that climate science can effectively address climate change are associated with higher climate change cognition levels and stronger emotional reactions [67].

2.2 Interpersonal and Social Interaction Close social circles influence climate change psychological reactions. Higher trust levels among family and friends facilitate climate change knowledge transmission between spouses [68], parents and children [69], and friends [70], while conformity pressure also prompts people to change their climate change attitudes and views, promoting convergence in climate change psychology [27].

Educational activities influence climate change cognition. Climate change education can directly enable learners to recognize the serious impacts of climate change on local, national, and global social, economic, and ecological dimensions [71]. Empirical studies also find that after participating in climate change-themed educational activities, children's worry about climate change [69] and related knowledge levels [72] significantly improve; climate change education is equally effective in shaping adult climate cognition [71].

Media communication influences climate change psychological reactions. Gen-

erally, scientific assessment reports published by research institutions and news released by governments or social organizations affect people's climate change understanding [73,74]. Chinese media's news coverage typically maintains a scientifically positive attitude toward climate change, which helps enhance people's risk awareness [65]. In the United States, research finds that non-conservative media coverage helps increase public trust in scientists, thereby strengthening climate change beliefs [75]; however, these media effects largely result from political and economic factors, with scientific information playing a minimal role [76].

2.3 Regional Natural and Cultural Characteristics Significant differences exist in climate vulnerability across global ecosystems and populations, leading to regional variations in climate change psychological reactions. While high certainty about climate change facts is generally expressed worldwide, worry about climate disaster risks is particularly strong in coastal areas with high climate vulnerability (e.g., Japan, Philippines), ecologically degraded regions (e.g., Brazil), and economically underdeveloped areas (e.g., Papua New Guinea) [31]. Non-white Americans face worse natural environments and lower economic development levels than whites, encountering more climate change risks and consequently showing higher worry levels [77].

Differences in cultural belief systems shape distinct worldviews and values, generating regionalized differences in climate change psychology. Compared to individualistic and hierarchical cultures, people in collectivist and egalitarian cultures consider their descendants more and pay greater attention to climate justice, thereby perceiving higher climate change risks [62,78]. From traditional and cultural heritage perspectives, Chinese culture, deeply influenced by Confucianism, Buddhism, and Taoism, emphasizes the value belief of "human-nature symbiosis," whereas Western culture under Jewish and Christian influence views nature as subordinate to humans [79], potentially making Chinese people more acutely aware of climate change threats. Cross-national surveys show that the proportion of people perceiving climate change as already threatening in China is more than double that in the United States [80].

2.4 National Climate Governance Models and Institutionalization National climate governance models and institutionalization levels affect social attention to climate change issues and actual response capacities, thereby influencing how citizens perceive and react to climate change. Some countries or regions have high levels of climate change institutionalization, emphasizing synergistic effects among legal frameworks, economic growth, and decarbonization. For example, the UK has established independent expert bodies to guide and evaluate climate change and integrated climate policy departments into business and industrial strategy departments [81], enabling top-down mobilization of public attention to climate change issues, resulting in widespread certainty that climate change is occurring and high levels of worry [31]. In contrast, countries or regions with low climate policy institutionalization, lacking empha-

sis on climate knowledge, and failing to connect climate change with economic growth (e.g., Saudi Arabia) [81] leave the public without adequate resources and channels to obtain climate change information, resulting in low anthropogenic attribution and insufficient risk cognition [31].

Western political systems' public political ideology differentiation leads to significant polarization in public attitudes toward climate change. Due to differential competition, interest group differences, and ideological polarization, different political parties in the West attach varying importance to climate change issues. Out of partisan identity, political leftists (e.g., US Democrats, UK and Australian Labor Party supporters) are more certain about climate change status and anthropogenic causes than rightists (e.g., US Republicans, UK and Australian Conservatives) [82]. In Western countries and regions with widespread political ideology polarization, particularly North America (US and Canada), Australia, and Europe (most evident in Germany and the UK, followed by Italy, France, and Spain) [83], climate change psychology polarization is also significant, especially in the US where the trend is increasingly expanding [84,85]; in developed Asian capitalist countries, ideological differences also affect climate change worry, as in Israel and Japan [83]. However, for most countries worldwide, partisan ideological differences do not affect public views on climate change [83]. In China, without multi-party system-based individual left-right political ideology differences, the public almost never doubts climate change facts (less than 0.5%), compared to Germany (approximately 10%) and the US (over 21%) where climate change skeptics constitute relatively high proportions [86].

3. Strengthening Climate Change Psychology Research and Application to Enhance Climate Response Capacity

Individual direct and indirect psychological interactions with climate change not only significantly affect personal wellbeing [87] but also influence individual and social climate response behaviors. As an important component of the climate change governance system, these interactions can either exacerbate or mitigate climate change processes. Therefore, whether directly improving public climate change cognition and low-carbon lifestyle transformation awareness through education and communication, or reducing public carbon footprints through improved climate policy design, must be based on scientific understanding of public-climate system interaction patterns. Addressing China' s current needs in building a climate-resilient society, we propose five recommendations.

3.1 Strengthen Database Construction for Public Climate Change Psychology

We recommend that relevant government departments and research funding agencies establish dedicated programs to support systematic public climate change psychology surveys, providing foundational data for climate change psychology research and social practice and establishing and improving basic databases in this field. Currently, various international research teams

have conducted long-term systematic surveys of public climate change cognition levels. Based on psychological characteristics of public climate change cognition, European and American countries have segmented populations into different types, such as “4 Types of Indians” [88], “6 Types of Americans” [89], and “5 Types of Germans” [90], providing targeted guidance for policy formulation, education, and climate communication. China’s surveys on public climate change cognition and attitudes started relatively late and lack systematic deployment. For example, the China Climate Communication Project Center released the “2017 Chinese Public Climate Change and Climate Communication Cognition Survey Report” covering 32 prefecture-level administrative units and 4 municipalities with only 4,025 samples, without continuous tracking or timely updates since; the Guangdong Qianhe Community Public Welfare Foundation conducted surveys in different community types in Guangzhou, Shenzhen, and Foshan in 2021, releasing the “Pearl River Delta Community Residents Climate Change Cognition Survey Analysis,” which has certain regional representativeness but requires further improvement in depth and breadth.

3.2 Establish Emergency Psychological Service Systems for Extreme Weather and Climate Events We recommend that government departments responsible for climate change, mental health, and disaster management incorporate public climate change psychology into overall climate change monitoring deployment, establishing emergency psychological service systems for extreme weather and climate events covering the entire process of emergency psychological preparation, emergency psychological response, emergency psychological intervention, and post-event evaluation and improvement.

Monitoring climate change psychology helps grasp regional characteristics of climate change psychology, identify typical features under different socioeconomic development levels and geographic environmental conditions, assess risk zoning of potential climate change disasters, and strengthen pre-positioning of relevant human, material, and financial emergency resources. Based on tracking data, we can longitudinally reveal temporal change patterns in climate change psychology, understand how external factors such as regional development, population migration, and natural geographic environmental changes affect climate change psychology, and examine the degree to which public psychological factors affect climate change adaptive capacity under different conditions, adjusting policies and public actions timely according to dynamic change patterns. Currently, China has established comprehensive meteorological observation and early warning systems for monitoring objective climate change risks and key groups; incorporating regional public climate change psychology into tracking monitoring systems can identify which regional populations have high climate change psychological adaptability (e.g., high climate change cognition, strong risk awareness, negative emotional reactions that effectively drive climate change action without causing mental disorders), combined with objective climate change disaster possibilities (e.g., complex geographic environments, backward economic and infrastructure conditions, incomplete policy guarantees), enabling targeted

pre-deployment of material equipment and emergency psychological service resources, emergency psychological preparation, timely emergency psychological response and intervention for directly affected populations after extreme weather events, and evaluation and improvement after intervention to perfect emergency psychological service systems.

3.3 Optimize Climate Change Action by All Citizens We recommend that relevant government departments and social institutions enhance climate change education and communication, optimize climate communication content and models, comprehensively improve public attention and awareness of climate change-related issues, and guide public active participation in climate change action.

Climate change education can occur in various formal and informal settings, including classrooms, laboratories, clinics, museums, and the internet, while ensuring educational content matches learners' cognitive levels. Various educational programs should focus on improving learners' understanding of how humans interact with nature, how climate change emerges from complex physical and human social interactions, and how climate change interrelates with other environmental issues such as environmental pollution, biodiversity loss, and deforestation [91]. Additionally, climate change education must attend to learners' mental health, guiding people to identify their feelings about climate change and express and act on them in positive ways (e.g., seeking social support), avoiding vicarious trauma from the educational process that could lead to depression, post-traumatic stress, anxiety, and other psychological problems [5].

Current mass climate change communication mainly exhibits characteristics of being "small, scattered, and miscellaneous." Although government guidance actively organizes environmental and climate education during specific periods such as "National Energy Conservation Publicity Week," "National Low-Carbon Day," and "World Environment Day," activity scales are often small, levels vary across regions, and public participation and sustained attention to climate change are difficult to guarantee. In the long term, climate change education and communication should strengthen systematic and standardized construction. The process of incorporating climate change into formal and informal education at all levels should integrate research findings from climate change psychology, developmental psychology, and educational psychology to develop professional climate change educational materials (e.g., textbooks, videos, outdoor programs) by interdisciplinary experts. In the academic education system, undergraduate, graduate, and postdoctoral students in psychology and related fields should be provided with climate change courses, research experience sharing, practice and internship guidance, and funding to increase talent reserves. In the science communication system, diversified funding should be used to strengthen development of related education products, enhancing the breadth, depth, and scientific quality of climate change mass communication.

3.4 Apply Objective Laws of Climate Change Psychological Reactions to Boost National Climate Governance

We recommend that relevant government departments such as ecology and environment and climate negotiation authorities fully reference intelligence data from domestic and international climate change psychology monitoring systems, incorporate climate change psychological factors into Chinese and international climate change policy formulation, and cooperate with research institutions and think tanks to timely grasp climate change psychology dynamics among Chinese and other parties' populations, further enhancing China's initiative in international climate game negotiations and influence in participating in international climate governance.

Psychology has demonstrated important roles in revealing public views and attitudes toward climate change, motivations for participating in mitigation and adaptation behaviors, designing behavioral intervention programs, and mitigating mental health threats [91], but its full potential requires broader participation by experts in climate change-related issues, including but not limited to science education [92], decision-making [93], organizational behavior [94], risk assessment [95], and disaster response [96], with full integration into top-level institutional design, public-level institutional implementation, and comprehensive policy effect evaluation in these fields. The introduction of climate change-related policies should fully consider and follow objective laws of climate change psychology. Before important policy introduction, pilot regions should be selected based on regional climate change psychology typical characteristics, such as using regions with high climate change cognition levels as carbon market pilot areas. During policy implementation, climate change psychology should be incorporated into examination of factors influencing policy participation, adjusting policies accordingly to promote broader public participation, such as how climate change psychology affects support for new energy vehicle subsidy policies and subsequent actual purchase intentions. During policy effect evaluation and reform, climate change psychology should be incorporated into examination of factors influencing policy satisfaction.

3.5 Strengthen Interdisciplinary Research Between Psychology and Climate Change-Related Disciplines

We recommend that relevant government departments, research institutions, and higher education institutions attach importance to climate change psychology research, increase research investment in relevant directions, especially support interdisciplinary integration research between climate change-related disciplines and psychology, enhance scientific understanding of public beliefs, attitudes, and cognition related to climate change, promote application of research results in public science communication, climate practice, and community participation, and facilitate policy formulation and international climate cooperation from a macro climate governance perspective.

Climate change psychology is an interdisciplinary field. Chinese scholars have accumulated certain research in the intersection of climate change psychology and

public policy, focusing on how climate change psychological reactions ultimately facilitate behavior change [97]. Existing research includes climate change risk cognition [98], explicit and implicit cognition of climate change [99], household energy conservation decision-making processes from behavioral decision and social norm perspectives [100], water-saving behavior at exhibitions [101], psychological motivations for low-carbon energy consumption behavior among urban residents [102], and psychological factors in public support for carbon inclusive policies [47]. Additionally, research on the effectiveness and impact evaluation of Chinese residential energy conservation guidance policies [103], rural green energy consumption guidance policies [104], policy text analysis [105], green consumption regulatory policy simulation experiments [106], information framing psychological manipulation [107], and laboratory simulation experiments examining optimization of carbon inclusive system design [108] have provided scientific foundations for relevant policy formulation and implementation. The research results from the Institute of Psychology, Chinese Academy of Sciences on “green low-carbon lifestyles” have provided important scientific support for documents such as the “14th Five-Year Plan for Ecological and Environmental Protection” and “Citizen Ecological and Environmental Behavior Standards Ten Articles.”

Climate change psychology requires further interdisciplinary cooperation with more disciplines. Natural science fields such as energy, environment, and materials need to strengthen research on individual behavior patterns, effective assessment of individual carbon footprints, and development of higher-efficiency daily facilities, closely integrating with psychological and behavioral interventions to improve actual intervention benefits. Factors influencing public low-carbon behavior include not only internal psychological perception and motivation but also objective factor assessments [109], such as green product prices, convenience, expected service life, and community infrastructure needed for residents to practice waste sorting. Therefore, cooperation between product development, social governance, and other disciplines with psychology helps jointly promote public practice of low-carbon green lifestyles from internal and external conditions.

National needs and disciplinary development have laid foundations for climate change psychology to become an independent emerging interdisciplinary field. Currently, China’s research in climate change psychology has not yet formed a complete system, with gaps in research depth and breadth compared to international levels [110]. As China’s influence in global climate governance continues to increase, strengthening climate change psychology research and promoting construction of a Chinese autonomous knowledge system in climate change psychology is urgent, which will also contribute Chinese wisdom and solutions to optimizing the global climate governance system.

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