Review Article

# AI Tools for Mitigating Mental Health Challenges Arising from Climate Change

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## I N F O

## A B S T R A C T

The threat that climate change poses to human mental health is becoming more widely acknowledged, in addition to its effects on the environment and the economy. Stress, anxiety, depression, post-traumatic stress disorder (PTSD), and cognitive impairments are among the direct and indirect psychological effects of extreme weather events such as floods, heat waves, droughts, thunderstorms, extended downpours, and wildfires. A disproportionate number of vulnerable groups are impacted, including children, the elderly, and people with pre-existing medical issues. The research on the relationship between artificial intelligence (AI) interventions, mental health, and climate change is systematically reviewed in this work. 2,947 articles were first obtained from 11 scientific databases, including Scopus, Web of Science, PubMed, IEEE Xplore, ACM Digital Library, and others, using a PRISMA-driven method. Nineteen papers were chosen for further examination after being vetted for language, relevance, duplication, and consistency with the study's goals. The paper emphasises how machine learning methods and artificial intelligence (AI) technologies can evaluate, forecast, and lessen the negative effects of climate-related events on mental health. The results show that curated technical repositories and multidisciplinary platforms give a greater percentage of pertinent research, even while huge databases offer extensive coverage. In light of climate change, the study highlights the potential of AI to enhance mental health therapies and points out areas that require more investigation.

**Keywords:** Mental Health, Climate Change, AI Tools, Extreme Weather, and Systematic Review

## Introduction

Climate change poses a serious threat to mental health in addition to environmental and economic concerns. The frequency and severity of extreme weather events, including floods, heat waves, droughts, thunderstorms, heavy rains, and wildfires, are rising. Economic loss, relocation, food insecurity, and community disintegration are indirect results of these events, while direct psychological implications include trauma, stress, anxiety, and Post-Traumatic Stress Disorder (PTSD).

### Floods

Because of the abrupt relocation, loss of loved ones, and devastation of their houses, survivors frequently experience

PTSD, sadness, anxiety, and sleep difficulties. Long-term depression illnesses, financial hardship, and pessimism might result from prolonged relocation and reconstruction difficulties. While older people may suffer from stress-accelerated cognitive deterioration, children frequently exhibit separation anxiety and nightmares.[1]

### Heat Waves

Aggression, anger, and impatience can all be made worse by prolonged exposure to intense heat. Research indicates that high heat events are associated with an increase in suicide rates, which are connected to both socioeconomic stresses and neurobiological stress. Heat affects workers and students by shortening attention spans, memory, and decision-making skills. Mental exhaustion and psychological anguish are more prevalent in those without access to cooling devices (air conditioning, green areas.[2]

### Droughts

Financial losses for farmers and agricultural communities result in long-term stress, despair, and, in severe situations, suicide. Affected communities experience worry, dread, and despair as a result of scarcity. Forced relocation brought on by drought can exacerbate loneliness and community breakdown by severing social ties. Children who grow up in areas hit by drought may experience emotional instability and a decline in resilience over time.[3]

### Thunderstorms

Particularly in youngsters, severe thunderstorms with lightning and strong winds can cause anxiety, phobias, and panic attacks. People who have experienced extreme storms (cyclones, tornadoes) in the past may acquire PTSD connected to climate change. Sleep loss brought on by loud, protracted thunderstorms exacerbates mental health conditions, including bipolar disorder and depression.[4]

### Excessive Rain

Extended rains might make it difficult to move around, which can result in feelings of loneliness and depression. In places that are vulnerable to flooding, constant rain frequently causes anticipatory worry. Prolonged rains can reduce sunshine, which can exacerbate seasonal melancholy and poor mood. Long rainy seasons cause boredom, exhaustion, and decreased motivation in both employees and students.[5]

### Wildfires

When family members or neighbours are harmed in a fire tragedy, exposure causes fear, PTSD, acute stress responses, and survivor's guilt. Breathing problems brought on by smoke inhalation, particularly in youngsters and those with asthma, intensify worry and anguish. Grief over displacement and a loss of identity are brought on by the destruction of private areas. Following a wildfire, communities suffer eco-anxiety, recurrence fear, and persistent.[6]
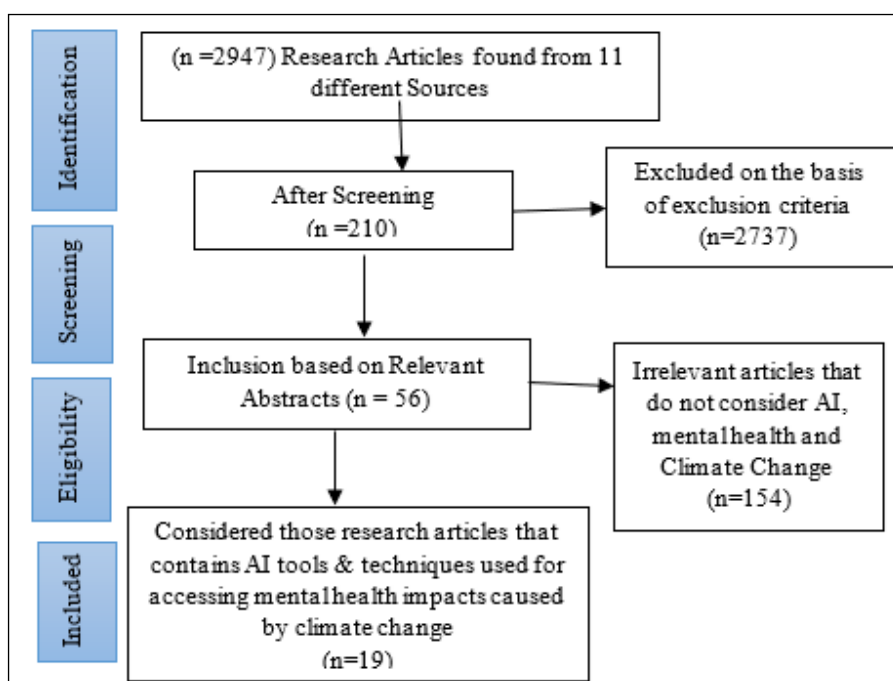
### PRISMA of Climate Change on Mental Health

The literature review across multiple databases yielded a total of 2,947 papers, out of which 210 remained after screening for relevance (refer to Table-1). Among the sources, Scopus had the highest initial results (1,192 papers), but only 38 qualified after screening, highlighting a broad coverage but lower specificity. Similarly, Web of Science (918 papers, 19 after screening) and PubMed (278 papers, 53 after screening) showed substantial volumes, with PubMed contributing the highest number of relevant studies post-screening. In contrast, Google Scholar, while returning a moderate 187 papers, resulted in only 21 relevant studies, reflecting the platform's tendency for broad but less filtered results. IEEE Xplore and ACM Digital Library showed relatively smaller pools (88 and 67, respectively), yet their screening efficiency was stronger with 13 and 14 relevant studies, demonstrating that technical repositories yielded more focused AI- and ML-related research. Interestingly, Springer Link (18 to 7) and Taylor & Francis Online (21 to 5) provided fewer total hits but higher proportions of relevance compared to larger databases.

Meanwhile, arXiv (24 to 8) contributed a niche set of preprints, and ResearchGate produced a surprisingly high 23 relevant papers out of 115, reflecting its growing role in interdisciplinary knowledge exchange. Overall, the analysis indicates that while large scientific databases provide a broader entry point, specialised repositories and curated platforms like IEEE, ACM, and ResearchGate yield a higher proportion of directly relevant studies for AI, climate change, and mental health intersections.

A total of 2,947 research articles were initially retrieved from 11 different sources like Google Scholar, Scopus, WOS, IEEE, etc. After applying screening criteria and removing duplicates, non-English papers, and unrelated studies, only 210 papers were retained. 2,737 papers were excluded at this stage due to not meeting basic inclusion criteria (refer to Figure-1). From the 210 screened papers, 154 were excluded because they did not simultaneously address AI, mental health, and climate change. This left 56 papers considered eligible, based on the relevance of their abstracts. Out of the 56 eligible articles, only 19 papers were finally included in the systematic review. These were selected because they specifically focused on the use of AI tools and techniques for assessing mental health impacts caused by climate change.

**Table 1.Databases accessed for finding relevant Research Articles**

| S.no | Source | Keywords | # of Papers | # of Papers After Screening |
|------|--------|----------|-------------|------------------------------|
| 1 | Google Scholar | Artificial Intelligence in Mental Health | 187 | 21 |
| 2 | Scopus (Elsevier) | 'AI' & "Climate Change" And Mental Health | 1192 | 38 |
| 3 | WOS | "Climate Change" And Mental Health | 918 | 19 |
| 4 | IEEE Xplore | 'AI' OR "ML" And Mental Health | 88 | 13 |
| 5 | Science Direct | "Climate Change" OR "AI"OR Mental Health | 39 | 9 |
| 6 | ACM Digital Library | Application of AI on climate Change & Mental Health | 67 | 14 |
| 7 | Springer Link | "Mental Health" And "AI" | 18 | 7 |
| 8 | Taylor & Francis Online | Review of Mental Health due to climate change | 21 | 5 |
| 9 | PubMed (Medline) | AI & Mental Health & Climate Change | 278 | 53 |
| 10 | arXiv | Impact of Mental Health due to climate change | 24 | 8 |
| 11 | Research Gate | Psychology + Mental Health OR Psychology +Climate change | 115 | 23 |
| Total | | | 2947 | 210 |



**Figure 1.PRISMA of Climate Change on Mental Health**

## AI Tools for Improving Mental Health

In recent years, the integration of Artificial Intelligence (AI) into mental health care has transformed the way individuals access support, manage stress, and build resilience (refer to Table-2). A wide range of AI-driven tools and digital platforms now provide personalised, accessible, and scalable interventions for emotional well-being. From chatbots such as Woebot and Wysa, which use Natural Language Processing (NLP) and Cognitive Behavioural Therapy (CBT) techniques to deliver real-time conversational support, to online therapy platforms like TalkSpace and BetterHelp, which connect users directly with licensed therapists, these tools cater to diverse psychological needs. At the same time, self-help and wellness apps such as Happify, SuperBetter, MoodFit, MindShift CBT, Shine, Calm, and HeadSpace empower users through gamified exercises, mood tracking, guided meditation, and relaxation practices, enabling proactive mental fitness. Collectively, these one dozen AI-enabled solutions represent a spectrum of approaches, ranging from self-care and stress reduction to structured therapeutic guidance, thereby illustrating how technology is becoming an essential ally in promoting and securing mental health in today's fast-paced, stress-prone world.[7]

The following Table-3 contains the summary of recent literature papers representing impacts of climate change on mental health. The machine learning methods as well as findings confirm different impacts on mental health like stress, anxiety, depression, PSTD, and mental disorders etc.

**Table 2.AI tools used for Improving Mental Health**

| S.No. | AI tool | Description |
|---|---|---|
| 1 | Happify | This is an App that helps users to support during their mental stress by providing mind games, brain activities, and mind exercises. |
| 2 | Companion | This app provides a behavior therapy on cognition to eradicate negative emotions. It analyses patterns of thoughts to identify behavioral shifts. |
| 3 | SupperBetter | It gamifies the user's cognitive process by offering some rewards and hurdles to flip the negative thoughts. |
| 4 | MindShift CBT | It works on stress and depression through interactive sessions with users thereby improves mood of users. |
| 5 | Woebot | Woebot is a conversational chatbot built around cognitive behavioral therapy (CBT) principles (with some influences from interpersonal therapy and DBT) to provide users with emotional support, mood monitoring, and psychological self-help tools via chat interactions. It uses natural language processing (NLP) to interpret user inputs and select "expert-crafted techniques" to respond appropriately. |
| 6 | TalkSpace | Talkspace is an online therapy / teletherapy platform that connects users with licensed human therapists via chat, video, and audio. It allows different modes of communication (text/messaging, video calls, phone) depending on the plan. It uses a subscription model: users pay a monthly fee to access therapy services. |
| 7 | MoodFit | Moodfit is a self-help / mental fitness app that helps users track mood and behavioral patterns and provides tools for self-care and emotional regulation. Key features include journaling, reminders / notifications, setting daily goals, mindfulness exercises, cognitive behavioral techniques, and reports / visualizations to detect patterns. |
| 8 | Wysa | Wysa is an AI-driven "wellbeing coach" / chatbot that aims to help users manage stress, anxiety, low mood, and related emotional challenges through conversational support, self-help techniques, and tools. It uses evidence-based techniques such as CBT, DBT, motivational interviewing, guided meditation, breathing exercises, yoga, micro-actions (small daily tasks) etc. |

| 9 | BetterHelp | BetterHelp is one of the largest online therapy platforms, connecting users to licensed therapists via video, audio, live chat, and messaging. Users fill out a questionnaire, then are matched to a therapist based on their preferences, needs, and therapist availability. |
|---|---|---|
| 10 | HeadSpace | Headspace is primarily a mindfulness / meditation app that offers guided meditations, breathing exercises, movement (light exercise / mindful movement), sleep tools, and themed courses. It recently also offers "mental health coaching" in some versions: online mental health coaches who help users develop habits, coping strategies, and personalized plans. |
| 11 | Shine | Shine is a mental wellness / self-care app focused on stress, self-confidence, emotional support, and resilience. It offers daily motivational messages, meditations, guided audio, reflective prompts, community content, and self-care tools. |
| 12 | Calm | Calm is another popular meditation and relaxation app. It provides guided meditations, breathing exercises, daily calm sessions, sleep stories / soundscapes, and visual/ ambient content to help users unwind and reduce stress. It often has "theme of the day" meditations, and content targeted to various needs (stress, focus, sleep, self-esteem). |

**Table 3.Summary of recent literature on Climate Change impacts on mental health**

| Reference | Psychological impacts | ML / DL methods | Findings |
|---|---|---|---|
| [8] | PTSD, depression, anxiety, sleep disturbance; long-term trajectories of distress after flooding | Longitudinal Clinical Assessment | Elevated PSTD in flood survivors |
| [9] | Acute trauma, chronic stress, displacement grief, community disruption | Vulnerability assessment studies reviewed; recommends integrating ML vulnerability mapping | High levels of mental distress in flood exposed |
| [10] | Indirect stress from repeated flood risk and loss | Supervised learning (RF, SVM), unsupervised clustering, MCDM for vulnerability mapping | Found high risk groups and vulnerable clusters |
| [11] | Increased mortality and ED visits for mental disorders during heatwaves; links to suicide risk | Time-series models; spatial/ temporal risk modelling (statistical + ML hybrids suggested) | Mental trauma due to heatwave intensity |
| [12] | Associations between ambient temperature and suicide/homicide rates | Regression, environmental exposure modelling; ML suggested for predictive risk mapping | Higher ambient temperatures correlate with increased suicide rates in some regions |
| [13] | Increased suicide and mood-disorder ED visits during drought, heat, and compound events | Spatial clustering, case-crossover and statistical ML for detecting hotspots | Drought periods had highest likelihood of spatial clustering for suicide and mood disorders |

| [14] | Chronic stress, depression, anxiety, increased substance use, suicide in agricultural communities | Limited ML usage in primary studies; the review calls for data-driven predictive approaches | Significant associations between drought exposure and mental disorders |
|---|---|---|---|
| [15] | Anxiety, depression, PTSD, cognitive complaints; stress from smoke events and evacuation | Studies mostly observational; some use exposure modelling; recommendations to use ML/NLP for syndromic surveillance | Chronic/persistent smoke exposure linked to worsened mental health |
| [16] | Emotional distress signals (fear, anger, sadness) evident in tweets during wildfire events | NLP / sentiment analysis, topic modelling, time-series of emotion signals | Social media reflected acute distress during and after wildfire events; NLP detected spikes in negative emotions |
| [17] | Climate-trauma concept: chronic PTSD, anxiety, cognitive impairment following wildfire exposure | Combines epidemiology with neurocognitive assessments; suggests ML for outcome prediction | Demonstrates links between wildfire exposure and long-term cognitive/mental health |
| [18] | Predicting PTSD / acute stress in disaster cohorts (floods, storms, fires) | Ensemble ML (random forests + gradient boosting), deep models for feature learning; multi-modal inputs (surveys, EHR, exposure metrics) | Ensemble approaches improve prediction of PTSD |
| [19] | Suicide risk patterns driven by social/economic factors that may interact with climate stressors | Unsupervised clustering, ML profiling on population data | ML can help locate communities where climate stressors (heat, drought, flooding) may amplify suicide risk |
| [20] | PTSD, anxiety, depression commonly after disasters | Few studies used ML for classification; review highlights growing use of data science for surveillance | Confirms substantial burden of mental disorders post-disaster |

## Limitations

Research on the effects of climate change on mental health has just recently got underway. Future research on the relationship between mental illnesses and severe occurrences might be beneficial. Studies on how people respond to landscape changes such as deglaciation, river loss, deserts, fires, and water shortages were not found. Another ideal objective is to have a better knowledge of the features of acute, subacute, and long-term repercussions. Additionally, we think that multidisciplinary studies will be a part of future research on climate change and mental health. Researchers want to concentrate on how various vulnerable populations may be impacted by climate change and natural catastrophes, as well as how to utilise the healthcare and preventive measures that are now available. The absence of a meta-analysis as a methodological conclusion to the systematic review is one of the descriptive review's limitations. This might be helpful in future studies to determine precise causal relationships between the effects of climate change and mental health issues like disorders and symptoms.

## Declarations

The authors declare that the work done for this publication is the original work, has not been submitted anywhere

else for the publication and it was conducted under the supervision Prof. (Dr.) Gurvinder Singh.

### Availability of Data & Materials

The literature resources and the relevant material collected from the main library of Guru Nanak Dev University Amritsar can be made available after the publication of this work.

## Conclusion

There seems to be substantial evidence of the impact that climate change has on mental health, according to the research and literature examined in this work. This research looked at how the general public, vulnerable communities, and at-risk groups were affected by global climate change. We decided to concentrate on severe occurrences, including those caused by heat waves, tornadoes, hurricanes, wildfires, floods, droughts, and rising temperatures. Suicide rates, clinical problems (e.g., depression, anxiety, sleep difficulties, PTSD, etc.), and distress symptoms have all been used to characterise the consequences. While some of these occurrences, like droughts or temperature increases, may happen more slowly and less acutely, the majority of them start quickly and show up as disasters, to which PTSD is frequently viewed as an iconic paradigm. However, we might argue that those who are more susceptible to weather and atmospheric phenomena might be more impacted by the slow but steady changes in the global climate and its effects, including rising sea levels, global warming, altered landscapes, and the disappearance of recognisable environmental landmarks.

**Author's Contributions:** GK is the corresponding author and the research scholar at the department of Computer Science, Guru Nanak Dev University Amritsar. She has conducted the PRISMA and collected all the materials relating to climate change, mental health and AI tools. AK PK helped in writing the manuscript. The whole idea of the work was conceived by GS and supervised the other authors to proceed.

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