



Climate Change for Emergency Managers

An Annotated Bibliography Tool

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FEMA

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Lead Authors

Angelyn Spaulding Flowers, J.D., Ph.D., Professor and Program Coordinator, Crime, Justice, & Security Studies Program, University of the District of Columbia.

Cotina Lane Pixley, M.S., Clinical Instructor, Crime, Justice, & Security Studies Program, Co-PD/PI UDC Homeland Security STEM Award, University of the District of Columbia.

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Introduction and Project Alignment

This report describes a new annotated bibliography centered on climate change and emergency management. A dynamic searchable database of annotated bibliographies generated from reports, refereed journals and periodicals, and other documents will enable those utilizing the database to search by key words and find climate change or climate change-related emergency management documents from a variety of disciplines. This will advance the discipline and practice of emergency management by compiling a publicly available centralized source or reference guide to an array of interdisciplinary materials related to climate change. The target audience for this database of annotated bibliographies includes anyone working in emergency management, emergency management faculty, researchers, and students, as well as the general public. The development and implementation of this database of annotated bibliographies aligns with the FEMA Strategic Plan 2022–2026, the Emergency Management Higher Education Research Agenda Thrusts, and the FEMA’s Next Generation Core Competencies.

FEMA Strategic Plan 2022–2026 Alignment

The project relates to each goal of the *FEMA Strategic Plan 2022–2026* (FEMA, n.d.). Table 1 describes how the information derived from the annotated bibliographies supports FEMA’s Strategic Plan 2022–2026.

Table 1: Alignment with FEMA Strategic Plan 2022–2026

Goals	Related Objectives	Database Contribution
Goal 1: Install equity as a foundation of emergency management.	Objective 1.3: Install equitable outcomes for those served.	Emergency management community will better understand the factors affecting a community’s vulnerability to and resilience from climate-related disasters.
Goal 2: Lead whole of community in climate resilience.	Objective 2.1: Increase climate literacy among the emergency management community.	Builds a foundational understanding of climate science, its impacts, and effective mitigation strategies.

Goals	Related Objectives	Database Contribution
Goal 2: Lead whole of community in climate resilience.	Objective 2.3: Empower risk-informed decision-making.	Facilitates access to and understanding of future conditions, data, and modeling, so they can be incorporated into risk assessment and planning tools.
Goal 3: Promote and sustain a ready FEMA and prepared Nation.	Position FEMA to meet current and emergent threats.	Supports FEMA in its efforts to envision, plan, and prepare for emergency disasters.

Emergency Management Higher Education Research Agenda Research Thrust Alignment

The project aligns with three of the research thrusts from the *Emergency Management Higher Education Research Agenda Research Thrusts* (FEMA Higher Education Program, 2018). Table 2 describes how the information derived from the annotated bibliographies supports the research thrusts from the emergency management higher education research agenda.

Table 2: Alignment with Emergency Management Higher Education Research Agenda

Research Thrust	Database Contribution
Justice, Equity, and Capacity Development.	Incorporates annotated bibliographies addressing how climate change disproportionately impacts disadvantaged and underrepresented groups and ways in which capacity might be developed among those who will remain at an elevated risk post disaster.
Risk Building and Disaster Exposure.	Annotated bibliographies enabling emergency managers, students, and other interested users to examine how cumulative personal and collective disaster loss influences development trajectories for individuals, family dynamics, and community resilience.
High-Risk Habitation Zones.	Annotated bibliographies addressing environmental and social vulnerability to both high-impact and chronic disasters.

Next Generation Core Competencies for Emergency Management

The project aligns with five core competencies and nine of their associated behavioral anchors from *Next Generation Core Competencies for Emergency Management* (Feldman-Jensen, Jensen, & Smith, 2017). Table 3 describes how the information derived from the annotated bibliographies supports the behavioral anchors of the core competencies.

Table 3: Alignment with Next Generation Core Competencies for Emergency Managers

Core Competency	Behavioral Anchor	Database Contribution
Operate within the Emergency Management Framework, Principles, and Body of Knowledge	Behavioral Anchor #1: Comprehensive	Enables the Emergency Management professional to consider hazards, phases, stakeholders, and impacts relevant to extreme weather disasters resulting from climate change.
Operate within the Emergency Management Framework, Principles, and Body of Knowledge	Behavioral Anchor #2: Progressive	Enables the Emergency Management professional to anticipate future disasters resulting from climate change, supporting them in their efforts to develop community-based frameworks that encourage, and support preventative and preparatory actions intended to build toward climate-resistant and resilient communities.
Operate within the Emergency Management Framework, Principles, and Body of Knowledge	Behavioral Anchor #7: Flexible	Supports the ability of the Emergency Management profession to utilize creative and innovative approaches in solving disasters deriving from climate change-induced events.

Core Competency	Behavioral Anchor	Database Contribution
Continual Learning	Behavioral Anchor #3: Contributes to a body of knowledge that spans disciplines	Interdisciplinary nature of the knowledge generated will focus inquiry at the intersection of relevant disciplines to gain a fuller understanding of the drivers of climate change-induced extreme weather consequences.
Geographic Literacy	Behavioral Anchor #1: Interaction	Supports recognition that the world is made of physical, built, and social systems, which interact with climate change impacts in multifaceted ways, producing varying levels of risk and vulnerability.
Geographic Literacy	Behavioral Anchor #3: Interconnection	Contributes to the understanding that people and places are connected in a dynamic network of global relationships.
Subcultural Literacy	Behavioral Anchor #1: Social Determinants of Disaster Risk	Advances understanding concerning the relationship between social factors and disaster risk concentration associated with the impacts of climate change.
Disaster Risk Management	Behavioral Anchor #1: Communicates and Interprets Hazards and Risks	Supports an Emergency Manager's efforts to clearly communicate and explain climate change hazard risks to a wide variety of stakeholders.

Core Competency	Behavioral Anchor	Database Contribution
Disaster Risk Management	Behavioral Anchor #3: Monitor, Evaluate, and Review Risk Management Processes and Outcomes	Enhances ability of Emergency Managers to monitor, evaluate, and review climate risk management processes and outcomes.

Background

Need

In the summer of 2021 approximately one-third of Americans lived in a county that experienced a weather disaster (Kaplan & Tran, 2021). By the following April, more than 2,000 residents of Arizona had been driven from their homes by a wildfire that burned an area larger than Manhattan (Reuters, 2022). That same month, an elderly couple in New Mexico died in their home as they attempted to flee a wildfire (Hay, 2022). Wildfires, heat waves, hurricanes, tornadoes, blizzards, mudslides, to name a few, are occurring more frequently. They are also occurring with a greater intensity, resulting in significantly higher levels of destruction. Hundred-year storms are occurring every year. Five-hundred-year storms are now occurring every 5 years. In the high warming scenario expected by the middle of the 21st century, not only will there be an exponential increase in wildfires in the western U.S., but approximately 90% of those wildfires will be followed by at least three spatially co-located extreme rainfall events (Touma, Swain, Kalashnikov, & Huang, 2022).

As the global scientific community continues to speak on the necessity to reduce our carbon footprint, the U.S., as other nations, is still wrestling with reducing its dependence on fossil fuels. Meanwhile, the impact of extreme weather continues to be catastrophic for the Nation's aging critical infrastructure. Decaying infrastructure can increase the impact of extreme weather on the people dependent on that infrastructure. For instance, during a series of winter storms across the U.S. in February 2021, the electrical grid in the State of Texas lost power, leaving millions without access to heat or electricity for days in sub-freezing weather. One year, billions of dollars, and hundreds of deaths later; the impact continued for many Texas residents (O'Hara, Miznazi, & Wiseman, 2022). A series of wildfires in California, Nevada, and Southern Oregon later that summer burned acreage half the size of the State of Connecticut, producing smoke that stretched all the way to New York (Ramirez, 2021). In the summer of 2023, smoke from Canadian wildfires placed a third of the U.S. population in the Midwest and Northeast under air quality alerts.

No matter the incident, nor how severe or extreme the weather, it is Emergency Managers who will respond. This is the world in which Emergency Management students will practice their craft. This is the reality for which they need to be prepared. However, when "experts" gather to discuss the impact of climate change, thought is not usually given to the implications for the practice of emergency management. Emergency Managers deal with the human side of climate change. Complicating this picture is that some populations are disproportionately impacted by extreme weather outcomes. This

can include communities that have been historically underserved or marginalized by race, ethnicity, language, or culture. It includes populations vulnerable because of age, disability, or lack of financial resources (Flowers, 2018). What these communities have in common is that they are more likely to lack the ability to successfully comply with emergency directives during a disaster and less likely to be resilient post disaster.

Current climate change efforts have been geared toward reaching a global temperature increase of no more than 1.5 °C or 2.7 °F. Due to the time lag in the inter-play between the climate system and human action, even with an immediate drastic reduction in greenhouse gas emissions, there will still be another 30 years of extreme weather fluctuations (Freedman & Kokalitcheva, 2021). The latest report by the United Nations Intergovernmental Panel on Climate Change (IPCC) suggests that while achieving the global temperature goal may be “technically” feasible, even if it is reached, the damage to the earth and its ecosystems could be irreversible (IPCC, 2022). The Emergency Manager of the near future will operate in this impacted world. This points to the urgent need to factor extreme weather into established emergency management practice and emergency management educational competencies.

Goals

Typically studied in environmental science, engineering, materials science, geophysics, risk science, and economics, to name a few, climate science has rarely been studied within a framework intended to address the question of what it means for the practice of emergency management. This research project is interdisciplinary as befits the multidisciplinary nature of climate change.

Project Goals

- Synthesize the disparate threads of climate change research into a useful unified construct for emergency management practitioners.
- Identify implications and recommendations for the practice of emergency management in this emerging future.
- Identify the manner in which vulnerable and marginalized populations are disproportionately impacted by these phenomena.

Scientists have developed a range of predictive climate models at various levels of global warming. Proactive emergency management means taking predictive scenarios for extreme weather events resulting from climate change and addressing three questions, each of which lends itself to research or case study development for classroom inclusion.

Questions

- If a particular scenario occurred, what would it mean in terms of anticipated weather events?
- In what ways would some populations be disproportionately impacted?
- What types of best practices should emergency management agencies adopt to manage or respond to these events?

A database of annotated bibliographies of climate change-related articles has been developed to support emergency management practitioners, faculty, and students in preparing for a world in which certain types of extreme weather events are the norm rather than the exception. In general, the purpose of an annotated bibliography is to not only provide in one place a collection of citations for relevant articles, reports, and other sources, but to also inform the reader of the relevance, accuracy, and quality of each of the cited sources (Cornell University, 2021). In addition to the citation, it includes a brief descriptive or evaluation paragraph of approximately 150 words or an abstract. Instead of a printed version of an annotated bibliography, this one will be in an electronic format which will be searchable by key words. The database can be used to build case studies of extreme weather events to enable students to develop an analytical response or for an Emergency Manager to see how events experienced in their jurisdiction have been addressed in other jurisdictions. Or the database can be used to support research on distinct aspects of climate change, the impact of climate change, and the implications of climate change for emergency management practice.

Database Description

The webpage supporting the annotated database can be found at: <https://cjss-ipsj.org/home/climate-change-for-emergency-management-annotated-bibliographic-database/>. As of June 2023, the database contained almost 300 annotated bibliographies from a diverse array of source material including government reports, journal articles, news reports, etc. As a dynamic database, the content is subject to change.

One component in the database development stage was the identification of key words (and definitions) to facilitate searches. Examples of categories of key words include the different types of extreme weather events, jurisdiction of the event, type of source, etc. Also included were key words such as “critical infrastructure” for those articles related to the impact of extreme weather events on aging critical infrastructure and “equity” for articles related to some aspect of underserved populations. This project specifically incorporates information on populations underserved or disadvantaged because of race, ethnicity, culture, language, disability, or income. This is essential for effective emergency management practice because many of the challenges faced by these communities are embedded and are therefore easily overlooked. These challenges can provide significant impediments to the ability of those communities to respond to and be resilient from extreme weather events.

The annotated bibliography database is housed in [Zotero](#) which uses “tags” for searching instead of “key words.” The database provides a consolidated listing of all content, as well as groups of annotations in subcollections. The database is searchable in its entirety as well as within a subcollection.

Accessing the Annotated Database

To request access to the Climate Change for Emergency Management Annotated Database, complete and submit the [Request Access form](#). While waiting for the request to be processed, take the time to download [Zotero](#) to enable database access. Zotero is a free download which, in addition to storing databases, can also be used to format references in documents. Maintenance and sustainment will be managed jointly by the Institute for Public Safety & Justice and the Homeland Security Research Lab – both part of the Crime, Justice, and Security Studies Program at the University of the District of Columbia. Questions about the tool should be directed to Dr. Angelyn Spaulding Flowers.

Database Subcollections

Table 4 provides a description of the subcollection content and quantifies the database in terms of its composition by indicating which percentage of the total annotations are attributable to each subcollection. Access to the subcollections is available once instructions, above, for “Accessing the Annotated Database” have been completed.

Table 4: Description of Subcollections

Category	Description	Annotation Percentage (n=284)
Climate Change & Curriculum	Articles that discuss the integration of climate change into University programs.	4%
Events/Incidents	News reports covering specific weather-related incidents either as they occur or in their immediate aftermath.	16%
Impact/Issues	News articles that address topical issues related to climate change or its implication for emergency management or homeland security.	28%
Journal Articles	Peer-reviewed articles on descriptive aspects of climate change or related to the impact of climate change.	26%
Other Databases	Webpages that contain links to other climate change-related collections.	1%

Category	Description	Annotation Percentage (n=284)
Reports	Reports issued by U.S. government agencies, international organizations, or Non-Governmental Organizations (NGOs).	12%
Studies/Tools	Graphs, models or mapping tools, or other visualizations, many of which can be manipulated to show different outcomes based on the variables utilized.	13%

The descriptions in Table 4 provide a gauge of the type of content contained in the subcollection. Events/Incidents, Impact/Issues, and Studies/Tools lend themselves to additional explanation. Both Events/Incidents and Impact/Issues contain annotations of news articles. The annotations in Events/Incidents describe news articles providing contemporaneous reporting on extreme weather events as they occurred or their immediate aftermath. The resources are useful for case study development. The subcollection titled Impact/Issues also contains annotations of news articles. These are more likely to be opinion pieces, editorials, or articles discussing climate-related issues or implications. They are useful for encouraging discussion of issues which can lead to further research. The Studies/Tools subcollection is the most diverse of the subcollections in terms of content typology. In addition to graphs and other visualizations, this subcollection includes interactive tools with adjustable variables enabling the assessment of risk for different types of hazards and different jurisdictions. Change is a characteristic of a dynamic database. While all the subcollections can expect to see additions, Events/Incidents and Impact/Issues, because of their nature, may also see deletions as specific events becomes history and subject to more detailed analysis which are then incorporated into the subcollections containing Journal Articles or Studies/Tools. These deletions would then be replaced with current extreme weather events.

Database Output

The database produces a list of annotations by search request which can then be copied to a Word document or other type of document. These annotations can then be used to find the associated document. Users may find it necessary to search behind their institution or organization's paywall for the complete version of some articles. Only open-source documents are included in their entirety in this database. These open-source documents are primarily found in the Journal Articles and Reports subcollections.

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