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Complex Impacts: Examining the Interactions of Multiple Climate and Non-Climate Caused Stressors on West Side Utahns

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Abstract

Climate change continues to have negative socioeconomic and health impacts globally, with disproportionately worse effects on the daily lives of historically marginalized individuals. In Utah, extreme temperatures, poor air, water quality, & wildfires create disparities among community members living around the Great Salt Lake's West Side. These effects may worsen as climate change is known to have links to a combination of interacting complex stressors, collectively referred to as multiple stressors. Despite these potential effects, a limited understanding exists of what multiple stressors Utah's West Side residents experience. Thus, the aim of this study was to conduct a literature review to investigate how climate change may interact with everyday stressors. Articles were selected based on their theoretical relevance to Utahns and categorized according to the key stressors they addressed. From the literature, four main climate-related stressors (heat, air pollution, drought, and wildfires) were chosen based on their relevance to Utahns, alongside six types of daily stressors (physical health, mental health, cognition, violence, financial strain, and sociocultural strain). From these themes, a framework was created that shows the complex ways these stressors connect and interact. The findings suggest that increased exposure to climate-related stressors is associated with adverse effects across multiple daily stressors. At the same time, there is extremely limited research directly examining this complex interaction between multiple stressors, specifically for marginalized individuals living around the Great Salt Lake in Utah. To effectively manage the complex stressors at play, a community-integrated approach is needed to spread awareness and mitigate climate change challenges faced by West Side Utahns.

Introduction

Climate change continues to worsen socioeconomic and health challenges for those regularly exposed to pollutants and extreme temperatures. For instance, past literature has documented an increased risk of certain lung diseases and an overall negative impact on the physical health of community members due to carcinogenic particles like PM2.5 in polluted air (Zhao et al., 2019; Oerther et al., 2024; Ma et al., 2024). Similarly, climate change is also known to impact mental health in a number of ways, including increased rates of depression, anxiety, stress, and insomnia (Boluda-Verdu et al., 2022; Greneski et al., 2022; Hickman et al., 2021; Ogunbode et al., 2023). While all community members are susceptible to the adverse effects of climate change, urban planning can systemically lead to underserved populations being disproportionately more exposed to pollutants and other climatic hazards, as well as a lack of resources to mitigate the negative effects (Baird, 2008; Feng et al., 2024; Green & Healy, 2022). Specifically in Utah, extreme temperatures, poor air and water quality, and wildfires can create systemic health and economic disparities among community members living around the Great Salt Lake in the West Side (Lohani et al., 2025a; Vowles et al.,

2020). The West Side is a colloquial term that typically refers to the zones west of Interstate 15 in the Salt Lake County area, where a significant portion of the residents are underprivileged ethnic minorities. This disparity in economic and educational background may stem from a historical practice known as redlining. Redlining involves dividing land zones in order to deny underprivileged groups (typically minorities) access to loans, systematically removing them from more desirable, less hazardous areas (Nelson et al., 2023). In Utah, specifically, more zones on the West Side were deemed "hazardous" compared to other parts of the city (Jones, 2021). One (of many) reasons to consider the West Side zones as hazardous is that toxic dust released from the continuously drying lakebed of the Great Salt Lake blows into the West Side, disproportionately affecting residents living in the area (Grineski et al.,2024). Still, limited research highlights the need to assimilate theoretical and empirical perspectives to build a comprehensive understanding of the complex challenges that are faced by the underserved communities living around the Great Salt Lake.

Systematic and empirical reviews have shown that climate change can contribute to a combination of complex interacting stressors known as multiple stressors (Räsänen et al., 2016; Ryan et al., 2024). A community may be vulnerable to several stressors occurring together, including economics, demographics, policy changes, and sociocultural factors, to name a few (Bennet et al., 2015). Multiple stressors could be categorized into climatic stressors that are directly caused by climate change stressors (e.g., air pollution, wildfires, and drought) or non-climatic stressors that are not caused by climate change (e.g., interpersonal violence). This distinction is made to acknowledge that even though climate change may not be the cause of non-climate-caused stressors, it can still exacerbate other existing stressors that are experienced by communities (Bennet et al., 2015; Lohani et al., 2025b; Räsänen et al., 2016; Ryan et al., 2024). Furthermore, the existence of co-occurring multiple stressors can be stressful and taxing to individuals' physical and mental health (Callender et al., 2022; Seon et al., 2024). There remains a limited understanding of the climatic and non-climatic multiple stressors experienced by Utah's West Valley residents. A comprehensive understanding of the underlying links between stressors is critical to be able to support underserved communities and better manage the disproportionate impacts they face in their everyday life. Thus, the aim of the current study was to conduct a literature review to investigate how climatic and non-climatic stressors interact in order to better understand the stressors at play for historically marginalized individuals. While we anticipated that limited research exists in Utah, we integrated literature from comparable communities more globally to create a theoretical framework for West Valley Utahns.

Method

The literature review was conducted using a variety of different academic databases (e.g., PubMed, PsycINFO, Google Scholar, etc.). After exploring available literature, a total of 30 scholarly sources were selected. Articles were selected based on their theoretical relevance to Utahns' experience of multiple stressors. Each source was thoroughly reviewed to determine the key stressors of the literature. From these key stressors, themes were created for both climatic and non-climatic stressors.

Themes for climatic stressors were chosen based on the climate issues most commonly affecting Utahns: Heat, Air Pollution, Drought, and Wildfires. Heat refers to any extreme weather events involving high temperatures, such as heat domes, heat waves, and general rising temperatures. Air pollution is a broader term that includes research on types of harmful substances in the air,

including particulate matter (PM), Nitrogen Dioxide, Carbon Monoxide, etc. Drought includes any instances of abnormally low rainfall, leading to a shortage of water. Wildfires, while related to air pollution by the harmful matter released during these events, were chosen as their own category for the unique set of challenges that they present from their more physically destructive nature.

Themes of non-climatic stressors were chosen based on common themes shared among two or more of the climatic stressors. The themes of non-climatic included Physical Health, Mental Health, Cognition, Violence, Financial strain, and Sociocultural strain. From these themes, a framework was created to showcase the complex ways in which these stressors connect and interact.

Results

To gain a descriptive overview, utilizing the key stressors that were found during the review process, a word cloud was created using the frequency of topics discussed in the literature. This method was chosen because many articles cover multiple topics, and counting article frequency would misrepresent how often each topic appears in the literature review.

Figure 1 *presents a word cloud of the key stressors through the literature review*

Heat interacts with non-climatic stressors

Heat, a climatic stressor, was included in most of the literature and was related to all the non-climatic stressors that were examined. Heat is associated with physical health, mainly through heat stress, which was also linked to a decline in cognitive ability and reduced productivity (De Sario et al., 2023; Ebi et al., 2021). Exposure to heat was also shown to significantly increase climate change anxiety in adults (Bratu et al., 2022) and increased emergency visits for mood disorders and suicidality for children and adolescents (Sewell et al., 2024). Heat was also shown to have a relationship with increased violence/aggression, potentially via physiological stress, disrupted development, and forced

migration (Miles-Novelo & Anderson, 2019). Evidence also suggests that marginalized and vulnerable groups like ethnic/racial minorities are also disproportionately affected by heat (De Sario et al., 2023; Slesinski et al., 2025). Considering the significant portion of residents on the West Side are ethnic and racial minorities (mainly Hispanic; Jones, 2020), these communities may also be disproportionality affected by heat.

Air pollution interacts with non-climatic stressors

Air pollution was another climatic stressor that was addressed in a substantial amount of research, much of which was specific to Utah. Specifically, considerable attention was given to fine particulate matter (PM2.5), as drying lakes like the Great Salt Lake are known to release these harmful particles into the air; however, other forms of pollution were also looked at. As previously mentioned, air pollution, specifically PM2.5, has been found to significantly worsen the risk for chronic obstructive pulmonary disease and causes inflammation, reducing lung function, and aggravating cigarette smoke effects (Zhao et al., 2019; Ma et al., 2024). Exposure to PM2.5 caused by wildfire smoke was also linked to increased suicide risk in the U.S., especially in more rural communities (Molitor et al., 2023). These findings are especially concerning, considering that research done in the Greater Salt Lake area shows that lower income, less education, and racial/ethnic minority status predict greater exposure to PM2.5 (Grineski et al., 2024; Mullen et al., 2020).

While research in Utah focuses mainly on PM2.5, other forms of air pollution are also shown to have harmful effects. For example, long-term exposure to air pollutants (e.g., NO_2, SO_2, CO, and PM10) in South Korea was also associated with a cognitive decline in older adults. Individuals exposed to higher levels of pollutants scored lower on a cognitive ability test and displayed faster decline over time (Park et al., 2022). Another study that looked into a variety of air pollutants in the U.S and India found an association in increased “unethical behavior” and criminal activity, most likely due to an increase in anxiety brought by pollutants (Lu et al., 2018). These findings highlight a need to explore a broader range of air pollutants and effects Utahns may be facing.

Drought interacts with non-climatic stressors

Drought was the climatic stressor with the most limited amount of research and the fewest connections to non-climatic stressors. Periods of drought were associated with a risk of suicide and mood disorder-related emergency visits in children, and the risk was increased threefold when compounded with the effects of heatwaves (Sewell et al., 2024). This shows how interaction between climatic stressors can increase risk and vulnerability. Drought events particularly affect agricultural workers, adding financial strain and increasing anxiety and risk perception of climate change (Howard et al., 2020; Rodziewicz & Dice, 2020). During certain events like the Great Californian Drought, marginalized communities were disproportionately impacted due to social inequalities, political vulnerability, and unequal access to water (Pompeii, 2020). This demonstrates how marginalized people tend to systematically bear the brunt of climate change and serves as a warning for what Utah’s West Side residents could face in the event of a similar crisis.

Wildfires interact with non-climatic stressors

Similar to air pollution, wildfires as a climatic stressor were linked to respiratory health, cardiovascular health, digestive disorders, diabetes, and chronic kidney disease in individuals due to

the harmful particles released into the air (Oerther et al., 2024; Ma et al., 2024). There are also observed associations between wildfire and mental health, as increased rates of anxiety, depression, PTSD, and suicidal ideation were seen in kids 5-18 (Oerther et al., 2024), and increased suicide risk in rural areas of the U.S. (Molitor, Mullins, & White, 2023). While research remains limited, there is some evidence suggesting that wildfires may be associated with cognitive decline, such as worsened effects of Alzheimer's disease (Schuller & Montrose, 2020). Wildfires also bring economic losses, including direct costs like property damage and loss of shelter, leading to forced migration, as well as indirect costs such as firefighting and control efforts (Kalogiannidis et al., 2023; Stougiannidou & Zafeiriou, 2020). Considering wildfires are a common occurrence in the state of Utah, it is important to understand the complex ways they may impact our communities.

Framework combining climatic and non-climatic stressors.

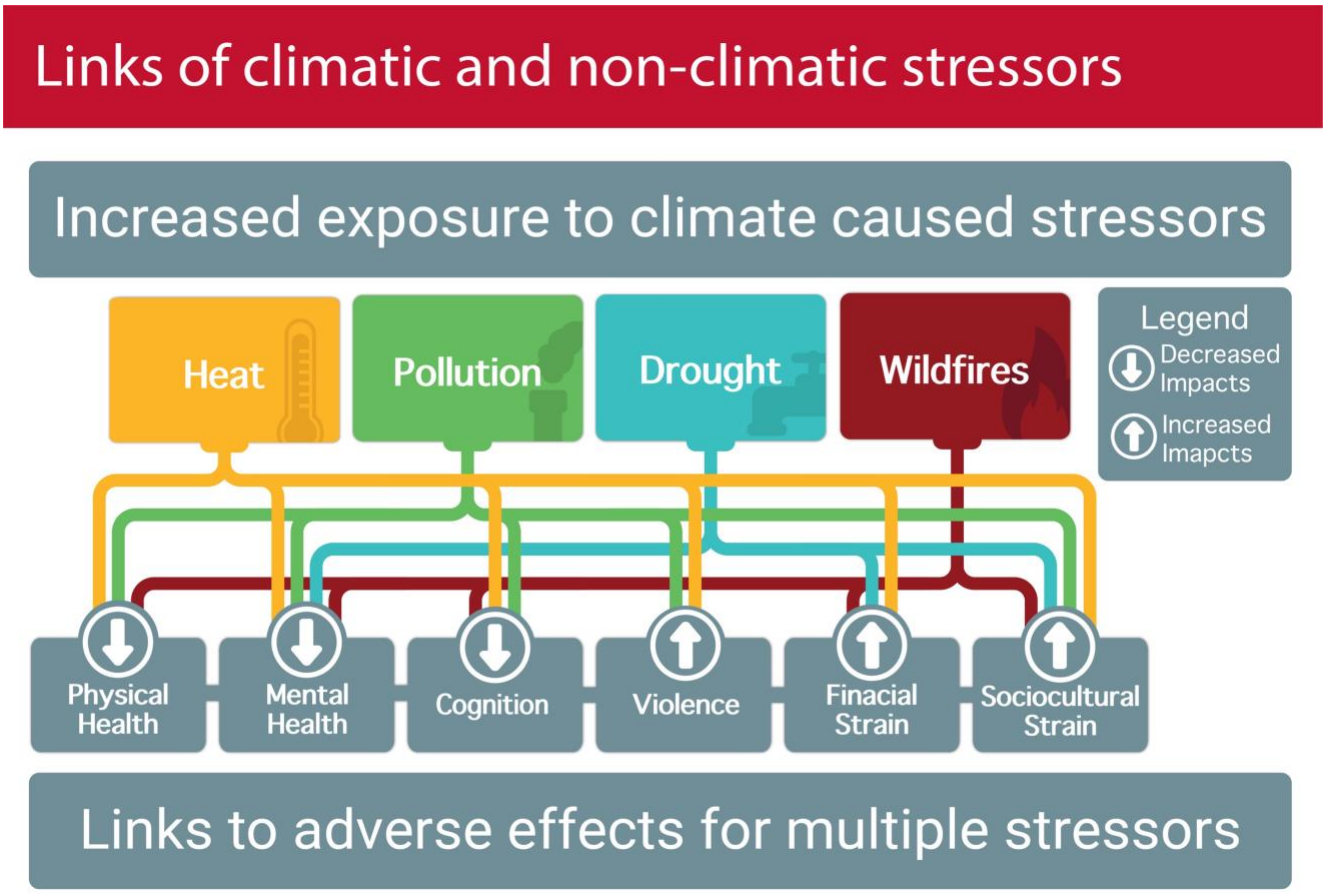

Figure 2 *presents the framework capturing multiple climatic and non-climatic stressors theoretically experienced by West Side Utahns.*

A framework was created to best represent the relationships found in the literature between the examined multiple stressors. See Figure 2 for the connections that were empirically supported by existing literature. Table 1 shows the studies empirically supporting the connections between climatic and non-climatic stressors as theoretically presented in the framework in Figure 2. While several

studies were available to support the connections between the climatic stressor heat and the non-climatic stressors, physical and mental health, the other climatic stressors had less support. This is because more studies focus on physical and mental health stressors, while cognition, violence, financial strain, and sociocultural strain remain less represented in the climate change literature.

Link between climatic and non-climatic stressors	Study	Key Finding
Heat and physical health	De Sario et al., 2023	Heat linked to increase risk for heat-related illnesses and deaths
	Ebi et al., 2021	Hot conditions associated with increased mortality and morbidity
Heat and mental health	Sewell et al., 2024	Heatwaves associated with increased spatial clustering for mood disorders and suicidality
	Bratu et al., 2022	Heat domes showed significant increase in climate-anxiety
Heat and Cognition	De Sario et al., 2023	Heat linked with decreased cognitive decrease performance
Heat and Violence	Miles-Novelo & Anderson, 2019	Uncomfortably warm temperatures increased irritability and increase propensity for violence
Heat and Financial Strain	De Sario et al., 2023	High temperatures associated with decreased productivity globally
Heat and Sociocultural Strain	De Sario et al., 2023	Shown to lower productivity of construction and agricultural workers
	Slesinski et al., 2025	Those of lower economic status, minority groups, immigrants were more likely to experience extreme heat
Pollution and physical health	Zhao et al., 2019	PM2.5 links to higher risk for chronic obstructive pulmonary disease and lung function
	Ma et al., 2024	PM2.5 linked to cardiovascular, ischemic heart disease, digestive, endocrine, diabetes, mental, and chronic kidney disease mortality
Pollution and Mental health	Molitor et al., 2023	PM2.5 Linked to increase suicide risk for rural communities
Pollution and Cognition	Park et al., 2022	Various harmful pollutants linked to decreases in cognitive ability among older South Koreans
Pollution and Violence	Lu et al., 2018	Pollutants linked to increased unethical behavior and criminal violence

Pollution and Sociocultural Strain	Grineski et al., 2024	In Utah minority groups and less educated individuals experienced disproportionately higher exposure to PM2.5
	Mullen et al., 2020	Schools in Utah with more racial/ethnic students and economically deprived students experienced unequal exposure to PM2.5
Drought and Mental Health	Sewell et al., 2024	Droughts associated with increased risk for mood disorders and suicidality
Drought and Finacial Strain	Howard et al., 2020	Farmers report financial loss due to drought
	Rodziewicz & Dice, 2020	Farmers losses from extreme drought
Drought and Sociocultural Strain	Pompeii, 2020	Inequities in water access for marginalized groups during the Great Californian Drought
Wildfires and Physical Health	Oerther et al., 2024	Wildfire exposure linked to increased risk for respiratory conditions
	Ma et al., 2024	Cardiovascular, ischemic heart disease, digestive, endocrine, diabetes, mental, and chronic kidney disease mortality were linked with wildfire exposure
Wildfires and Mental Health	Molitor, Mullins, & White, 2023	Wildfire exposure linked to increased suicidality
	Oerther et al., 2024	Wildfire exposure linked to anxiety, depression, suicidal thinking, and post-traumatic stress disorder in young people (e.g., adolescents)
Wildfires and Cognition	Schuller & Montrose, 2020	Wildfire associated with cognitive decline in Alzheimer's
Wildfires and Financial Strain	Stougiannidou & Zafeiriou, 2020	Wildfires have economic effects from direct cost (e.g., damage to crops, livestock, infrastructure) and indirect cost (e.g., fire response)
Wildfires and Sociocultural Strain	Kalogiannidis et al., 2023	Damage to property from wildfires forces migration or homelessness

Table 1 Literature and findings of Multiple Stressors

Discussion

The current study aimed to conduct a literature review to investigate how climatic and non-climatic stressors interact to better understand what stressors are at play for historically marginalized individuals. This work led to the development of a framework that illustrates the overlapping climatic and non-climatic stressors at play for underserved communities living around the Great Salt Lake. The framework displays the complex ways climatic and non-climatic stressors interact, showcasing how increased exposure to climatic stressors is linked to adverse effects for multiple non-climatic stressors.

The negative effects of non-climatic stressors are compounded by their interactions with climatic stressors, increasing the vulnerability of historically marginalized communities in Utah.

While research conducted in Utah was limited, existing literature suggests significant disparities in exposure to climate effects among historically marginalized groups (Grineski et al., 2024; Mullen et al., 2020). These historically marginalized groups may be less equipped to deal with the heightened effects of multiple stressors. Furthermore, the majority of the research examined relationships between climatic and non-climatic stressors individually and does not explore the potential relationship between them. For example, an article may examine the multiple negative outcomes associated with a certain climatic stressor but fail to measure how that stressor interacts with other non-climatic stressors. This presents a need to examine these multiple stressors together as their interactions potentially worsen their effects. Together, this work provides a useful framework to examine the underlying stressors at play for individuals living on the West Side. While limited research was available specific to Utahns, we integrated information from comparable communities to inform this framework. Future work is ongoing to test this theoretical framework, specifically with Utahns, to better adapt it to the needs of West Side communities.

This review should be considered with the following limitations in mind. First, there was a limited amount of research on certain stressors. In our review, we did not find a comparable number of studies across different stressors. The literature on drought was especially limited compared to other climatic stressors. This is most likely due to the majority of the literature on drought focusing on resource scarcity experienced by individuals in underdeveloped countries. The available research focusing on communities similar to Utahns highlighted mental, financial, and social challenges brought forth by droughts, but connections to other non-climatic stressors may also exist. Another limitation of the current review is that we only focused on interactions between climatic and non-climatic stressors, but we acknowledge that other research exists within climatic and non-climatic stressors, as well as non-climatic stressors with other non-climatic stressors that may impact the overall effect that should be considered in future research. While the current work utilized existing research to inform a theoretical framework, community input is imperative, which is the next stage for this research. Future efforts to understand the multiple stressors experienced by Utahns should consult vulnerable communities directly to better understand their needs, and community members should be involved in idea generation and implementation of solutions to these complex stressors (Lohani et al., 2025a). This will allow for more tailored community-informed solutions to be developed for community members in order to bring real change (Lin et al. 2021). To gain a comprehensive understanding of multiple stressors experienced by underserved communities in everyday life, variability over time should be captured through longitudinal data and by adopting ecologically valid approaches (Lohani & Blodgett, 2025). to other non-climatic stressors may also exist. Another limitation of the current review is that we only focused on interactions between climatic and non-climatic stressors, but we acknowledge that other research exists within climatic and other climatic stressors as well as non-climatic with other non-climatic stressors that may impact the overall effect that should be considered in future research. While the current work, utilized existing research to inform a theoretical framework, community input is imperative, which is the next stage for this research. Future efforts to understand the multiple stressors experienced by Utahns should consult vulnerable communities directly to better understand their needs, and community members should be involved in idea generation and implementation of solutions to these complex stressors (Lohani et al.,

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Overall, this study contributes to the limited research on the interactions between climatic and non-climatic stressors for Utah's West Side communities through the creation of a conceptual framework informed by existing literature. This work showcases how these stressors do not act in isolation but interact in compounding ways that intensify their overall impact. A detailed understanding of the complex stressors at play will help initiate targeted support systems that are necessary to help community members develop effective strategies for managing the emotional distress caused by the multiple stressors they encounter (Lohani et al., 2025c). In addition, efforts towards educating community health workers in identifying and effectively managing these complex stressors may be an effective strategy to help mitigate their effects for these marginalized groups. Educational materials and outreach efforts will be necessary to help support the underserved community members of Utah. A community-engaged approach can bring awareness about the disproportionate impacts, empower marginalized communities, and support efforts to address the complexities of climatic and non-climatic stressors.

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