

The Ripple Effects of Climate X-Events

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Abstract

The increasing global average temperature and the emergence of various abnormal climate phenomena are already being experienced in reality. The problems arising from climate change are expanding and becoming catastrophic, despite the efforts of various organizations to prevent them. In order to avoid climate issues from becoming black elephants, we conducted interviews with emergency planning officer from various institutions to identify potential X-events caused by climate change. The results of analyzing the anticipated X-events by these emergency planning officer revealed a chain of ripple effects associated with their occurrence. This implies that once an X-event happens, its influence is broader and more significant. Through this study, we aim to share the understanding of the ripple effects of climate X-events with many people, raising awareness of the severity of climate issues. We hope that this will serve as a starting point for more institutions, individuals, and nations to make efforts in resolving climate problems, turning X-events into opportunities rather than crises.

Keywords: X-event, Climate, Ripple Effect, Crisis, Black Elephant, Opportunity

1. INTRODUCTION

The seriousness of climate change is evident through various phenomena occurring in reality. Figure 1 illustrates the difference in average temperatures from 1951 to 1980, showing a steady rise in global average temperature[1]. Alongside temperature increase, seasons are changing, disasters are becoming more frequent and intense, and various climate-related problems are arising. Extensive research by numerous institutions has been conducted on the problems that may arise due to climate change, and the risks associated with climate change have been warned for a long time.

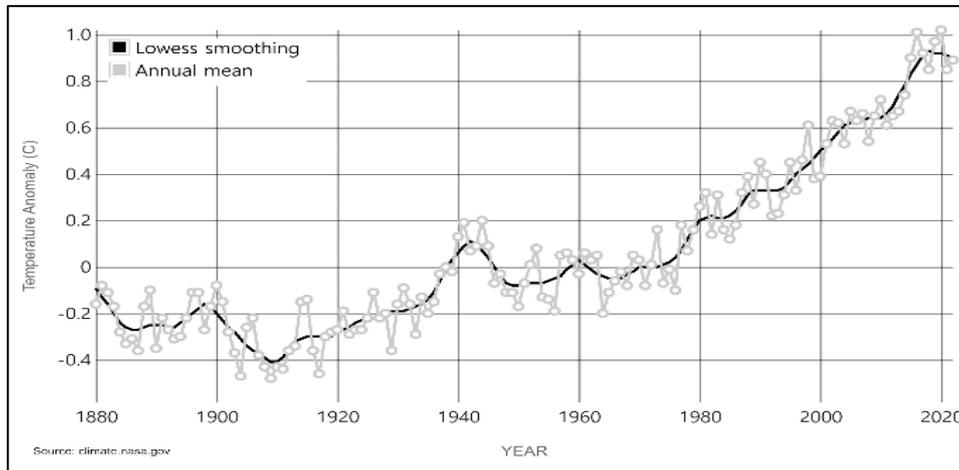


Figure 1. Global Land-Ocean Temperature

One prominent example is the Paris Agreement, It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016. Its overarching goal is to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels” and pursue efforts “to limit the temperature increase to 1.5°C above pre-industrial levels”[2]. In addition to the Paris Agreement, the Intergovernmental Panel on Climate Change (IPCC) publishes reports related to climate change, and the issues that can arise due to climate change, as presented in the IPCC's Sixth Assessment Report (AR6) published in March 2023, are depicted in Figure 2[3].

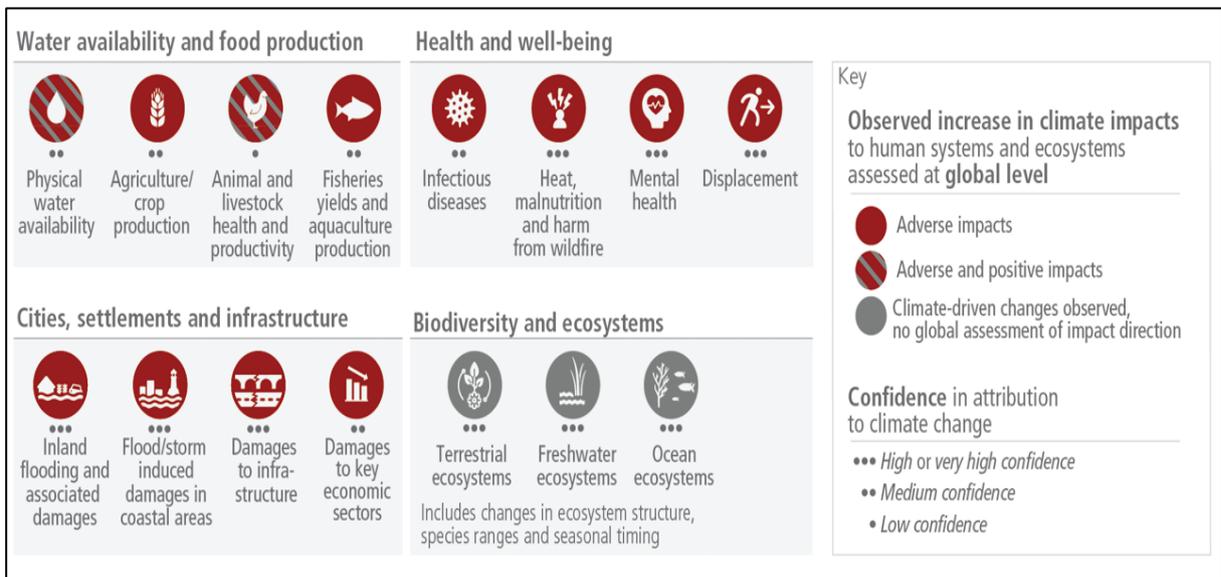


Figure 2. Impacts and Related Losses and Damages Attributed to Climate Change

Despite these diverse efforts, climate change problems persistently persist. In the book "The Limits to Growth" published by MIT Sloan School of Management, it warns that such changes on Earth "will eventually pose very serious risks and will be a situation we have never experienced before"[4].

The purpose of this study is to explore what serious risks can arise due to climate change, what situations we have never experienced before, and to identify climate-related X-events and the potential problems they may cause. Considering the characteristic of X-events as events that are difficult to predict and occur unexpectedly in unforeseen places[5], interviews were conducted with emergency planning officers, experts responsible for preparing for emergencies in various organizations, to identify potential climate-related X-events. These experts continuously research action procedures in response to unforeseen situations while always considering various unexpected scenarios. Through their expertise and insights, this study aims to raise awareness of the severity of climate change by examining their speculated X-events and contribute to preparing for and mitigating the impact of climate X-events, preventing them from becoming disasters.

2. THEORY

X-events refer to new types of events that are difficult to predict and interpret using conventional thinking, while also having significant social and economic ramifications. These events are characterized by low probability of occurrence, extreme surprise, and the inability to calculate their probabilities. Typically, the frequency of events is estimated using probability distribution curves, but X-events do not follow such curves because they have never occurred before.

However, they are events that can occur someday. Therefore, John Casti emphasizes the importance of building resilience to prepare for such X-events. Despite being highly shocking, effectively harnessing these external shocks can turn crises into opportunities[6]. In this study, we aim to identify climate-related X-events by surveying emergency planning officers working in various organizations. By early recognition of the identified threat factors, the purpose is to prevent significant disasters caused by climate X-events and transform potential crises into opportunities.

3. EXPERIMENTS

We conducted interview surveys with 32 emergency planning officers to identify potential climate-related X-events. These officers work in various fields, including public institutions and private companies, and their gender and age groups were diverse. Each interview took approximately one hour, starting with questions about recent climate-related issues and the climate-related issues their organizations are facing. We also asked them about potential X-events that could occur in the near future. The results of the interview surveys revealed both similar and unexpected opinions among the respondents.

One significant finding from this interview survey is that climate-related X-events are not isolated occurrences; rather, they trigger a chain of interconnected events. As one event unfolds, it leads to the occurrence of other events. Additionally, we discovered that one event can have multiple ripple effects across various fields. The X-events anticipated by the emergency planning officers and the subsequent interconnected events can be summarized as follows:

Table 1. Emergency Planning Officers' Opinion

No	Global Warming
1	Increased carbon emissions lead to global warming, causing glacier melting and temperature rise.
2	Temperature rise leads to glacier melting and sea level rise, resulting in coastal cities being submerged.
3	Global warming triggers natural disasters and calamities.
4	Climate-related disasters lead to societal disturbances.
5	Accelerated Global Warming from Uncontrolled Development
6	Global warming causes ecosystem disruptions, leading to disease spread and societal upheaval
7	Global warming leads to food shortages and potential humanity-threatening scenarios
8	Global warming causes rising sea temperatures, reducing agricultural output, and leading to typhoons causing property damage
9	Global warming leads to extreme weather events like summer flooding and winter cold snaps, causing energy shortages and lifestyle changes
10	Global warming causes environmental destruction, resulting in frequent climate-related disasters like heatwaves, heavy snowfall, and droughts.
11	Global warming leads to water scarcity.
12	Global warming causes ecological destruction, resulting in chain reactions.
13	Global warming leads to food crisis.
14	Global warming causes shifts in seasons.

No	Environmental pollution
1	Environmental pollution leads to abnormal climate occurrences, creating an environment that is challenging for survival and increasing the incidence of diseases.
2	Environmental pollution increases the frequency of abnormal climate events.
3	Environmental pollution accelerates global warming and leads to an increase in the frequency of disasters and calamities.
4	Environmental pollution accelerates global warming and results in human casualties and property damage from the occurrence of disasters and calamities.

No	Abnormal climate
1	The frequency and intensity of disasters and calamities increase
2	Abnormal climate leads to food crises, causing international disputes
3	International conflicts arise due to food crises caused by abnormal climate.
4	The frequency of disasters and calamities rises
5	Rapid onset of abnormal climate leads to a lack of preparedness, causing social disturbances.
6	Ecological disruptions and survival threats arise from abnormal climate.
7	Crop failure occurs due to food crises caused by abnormal climate.
8	Increased demands on disaster management and spreading of security threats due to abnormal climate.
9	Ecological disruptions and food shortages from abnormal climate lead to conflicts between nations and societal upheaval.
10	Loss of human lives and properties due to inadequate preparation for abnormal climate.
11	Increased occurrence of food crises due to abnormal climate.

4. RESULTS AND DISCUSSION

The relationships between the X-event proposed by emergency planning officers and the potential cascade of events can be summarized as shown in Figure 3.

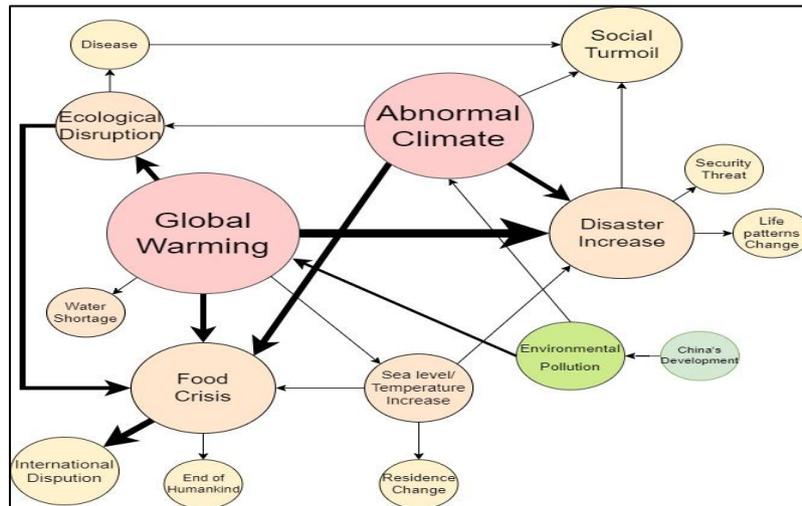


Figure 3. X-event Climate Analysis Results

The red circles represent the triggering factors, which, according to the survey results, were identified as "global warming" and "abnormal climate." The secondary events that may occur due to these triggering factors are indicated by orange circles, and the yellow circles represent tertiary events that could arise as a result of

the secondary events. The thickness of the lines and the size of the circles reflect the frequency, with thicker and larger ones indicating higher occurrence rates.

Analyzing the diagram, it was observed that the secondary events resulting from global warming and abnormal climate are primarily an increase in disasters and calamities and food crises. These secondary events can lead to more significant impacts, such as the end of humanity, international disputes, security threats, changes in lifestyle patterns, and societal disruptions. Furthermore, additional perspectives were identified, such as anticipated changes in residence due to rising sea levels, alterations in outdoor activities due to increased disasters and calamities, and shifts in lifestyle patterns. It is intriguing that climate-related X-events can lead to a series of consequences, spanning from ecological disruptions to societal and international issues, including security concerns. Moreover, the findings revealed that the events anticipated from climate X-events are interconnected, meaning that the impact of one event can amplify the effects of others. This indicates that climate-related X-events can have a far-reaching influence, impacting various domains simultaneously.

5. CONCLUSION

Through this study, it has been confirmed that climate-related X-events can originate from a single event and extend into various and wide-ranging consequences. Different opinions have been emphasized by climate-related organizations, ranging from the risks of global warming to national security threats, changes in lifestyle patterns, and even the potential end of humanity.

Climate issues have been frequently compared to a "black elephant" scenario. The term "black elephant" is derived from "elephant in the room," referring to a looming disaster that is visible to everyone, yet no one wants to address. The character of the "black elephant" resonates with the concept of the "risk of Cassandra," which refers to highly probable, catastrophic risks that people are unwilling to acknowledge due to the slow, prolonged effects of environmental degradation[7].

Continuing to ignore climate issues and treating them as "black elephants" can lead to X-events that pose unexpected and significant threats to us. Starting with this X-event study, further research should be conducted in various fields and target different groups and more people. By sharing the implications of climate-related X-events analyzed in this research, we hope to raise awareness of the seriousness of climate issues. Additionally, this study can serve as a starting point for preventing X-events from turning into disasters and instead transforming them into opportunities.

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