

A Study on the Classification of Natural Disasters in the Climate Crisis Period

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A B S T R A C T

This is an age of climate crisis. The natural phenomena that occur at this time are strong torrential rains and floods, extreme droughts, water and food shortages, marine acidification, sea level rise, and ecosystem collapse, which may lead to the end of mankind. This natural phenomenon is not a natural disaster in the traditional sense that has threatened humanity for a long time, but a natural disaster caused by new factors occurred by excessive human greenhouse gas emissions. It is very important to accurately identify the cause of the disaster and respond customarily. Therefore, this report aims to distinguish between traditional natural disasters and climate crisis natural disasters. The reason for this subdivision of natural disasters is that there is not much way to eliminate the cause of traditional natural disasters, but the climate-crisis natural disasters can reduce their occurrence a lot depending on how humans do it. The purpose of this study is to minimize damage from disasters, and ultimately to respect and implement the universal values of human life, human dignity, and human fundamental rights by protecting human life and property.

Key words: climate change; climate crisis; natural disasters; traditional natural disasters; climate crisis natural disasters; carbon neutral; classification of natural disaster; greenhouse gases; GHG

1. Introduction

1.1 Background and purpose of the study

Eunice Newton Foote (1819~1888), who proved the Earth's greenhouse effect for the first time, and Charles David Keeling (1928-2005), who completed the Keeling Curve through field experiments during his lifetime that the concentration of carbon dioxide in the atmosphere is increasing, and James Edward Hansen (1941-) who demonstrated the urgency and gravity of climate change for future generations in action, thanks to the efforts of several pioneers, we can understand the reality of a warming planet. (Kim Chu-ryeong, 2021: 24-45).

For future generations, including Eunice Newton Foote(1819~1888), who first proved the Earth's greenhouse effect, and Charles David Keeling(1928~2005), who completed the Keeling Curve through field experiments during his lifetime that the concentration of carbon dioxide in the atmosphere is increasing. James Edward Hansen (1941~), who showed the seriousness of climate change in action, made it possible for us to know the phenomenon of the earth's warming(Kim Chu-ryung, 2021: 24-45).

In 1962, Rachel Carson's 'Silent spring' was published, which brought to light the seriousness of environmental problems. In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established. The IPCC is UN-affiliated organization established to analyze the impact of climate change on the economy and social activities of mankind to provide evaluations of scientific and technical facts and to come up with international countermeasures.

In 1992, the Earth Summit was held and the United Nations Framework Convention on Climate Change (UNFCCC) was signed in Rio, Brazil.

As a result, the perception that global warming is progressing due to greenhouse gases has spread to international academia, and the world has begun to jointly come up with countermeasures. Greenhouse gases are gaseous substances that absorb infrared rays, which are global radiation energy reflected from the surface and cause global warming, and refer to carbon dioxide (CO₂), methane (CH₄), nitrous oxide(N₂O), hydrogen fluoride (HFCs), perfluorosulfur (PFCs), and other hydrogen fluoride (HFC-125) substances prescribed by Presidential Decree. Subsequently, the Kyoto Protocol, which imposes legally binding and greenhouse gas reduction targets on major developed countries, was adopted at the Third United Nations Conference of the Parties (COP) held in Kyoto, Japan in 1997.

However, the Kyoto Protocol, which is centered on major advanced countries, excluding developing countries such as China and India, has faced limitations, with the U.S., the world's largest emitter of greenhouse gases, withdrawing from the pact in 2001. The Paris Agreement was signed in 2015 for the first time in which 195 countries should work to limit the average global temperature rise to 1.5°C or lower, and the "New Climate System" began in 2021 (Ministry of the Environment, 204-111; Chungbuk Policy Development Center, 2021).

Despite these international efforts, greenhouse gases in the atmosphere continue to increase compared to before the Industrial Revolution (KEI, 2021: 338). The global average concentration of CO₂, which accounts for 91.5% of the total greenhouse gases, recorded 409.8 ppm in 2019, and the average concentration observed at the Anmyeon island Climate Change Monitoring Center in Korea recorded 417.9 ppm in 2019 (Korea Meteorological Administration, 2020.11.17).

Among the top 20 countries with cumulative greenhouse gas emissions since industrialization, Korea ranked 20th in the world with a total greenhouse gas emission of 701.4 million tons CO₂-eq and a net emission of 661.8 million tons CO₂-eq as of 2019 (Statistics Research Institute, Statistics Korea, 2022: 90-91).

In 2019, the total greenhouse gas emissions per population in Korea were 13.6 tons CO₂-eq, up 99.1% from 1990. The reason for the increase in greenhouse gas emissions per capita is that the increase in greenhouse gas emissions due to industrial development was greater than that of population growth. The growth rate of greenhouse gas emissions from 1990 to 2019 was 140.1%, far exceeding the population growth rate of 20.6% (Ministry of Environment, General Information Center of greenhouse gases, 2022: 43).

The Dutch Environmental Assessment Organization estimated that the world emitted 57.4 billion tons of greenhouse gases in 2019, and by country, China accounted for 14 billion tons of CO₂-eq, accounting for about 27% of the world's emissions (Park, 2021: 77, 97).

These over-exhausted greenhouse gases act as "the blanket of the Earth," which leads to climate change, causing abnormal temperatures, heat waves, torrential rain, extreme droughts and heavy snow, and cold waves, eventually leading to a climate crisis that threatens the entire planet (Cho, 2021: 9).

Article 2 of the Carbon Neutrality Act stipulates that climate change poses an irreparable risk to human civilization, including water shortages, food shortages, ocean acidification, rising sea levels, and ecosystems. In addition, considering the impact of future climate change, it is estimated that the maximum amount of natural disaster damage that will

occur during the period 2020-2060 will reach 8.85 billion dollar per year (current value in 2019) (Lee Mi-yeon, 2020: 56).

In the UNDRR(United Nations Officer Disaster Risk Reduction)'s World Disaster Report, a total of 7,348 natural disasters have occurred in the world over the past 20 years (2000~2019), which has damaged 4 billion people, with 60,000 disaster deaths every year. By country, China has the largest number of cases with 577, followed by the U.S. (467 cases), India (321 cases), the Philippines (304 cases), and Indonesia (278 cases), with eight Asian countries, with casualties concentrated in low-income countries, quadrupling the number of deaths in developed countries.

As a result of comparing the disasters in the last 20 years (2000~2019) and the previous 20 years (1980~1999), the number of occurrences increased 1.7 times from 4212 to 7,348, and the number of deaths also increased slightly from 1.19 million to 1.23 million. Of the total disasters, 90% (6,671) were related to climate change, and the most common types of disasters were floods (3,254) which accounted for 44% of the total.

In particular, frequent floods are expected to cause economic damage to Asia, and given China and India's share of the global manufacturing supply chain, the more frequent disasters occur in the region, the greater the impact on the global economy (Ministry of Environment, 2022: 79).

Among natural disasters, there is a need to differentiate strategies between the traditional natural disaster caused by pure weather phenomena that humans have experienced for a long time and the climate crisis caused by human greenhouse gas emissions. If the cause of occurrence is different, the way to deal with it should be different.

A detailed analysis of the causes of disasters is a shortcut to minimizing disaster damage. In addition to academic research on each type of disaster, 'concept definition' or 'classification system' is very important in implementing practical policies (Lee Jae-eun, 2018: 206).

Therefore, the purpose of this study is to minimize the damage to the lives and property of the people by classifying the concept of natural disasters in more detail and providing a theoretical basis for taking sophisticated measures.

1.2 Scope and method of research

Disaster types are classified in various ways by many scholars and institutions, and Korea's current Disaster and Safety Management Framework Act (hereinafter referred to as the Disaster Safety Act) largely divides them into natural disasters and social disasters (Lim *et al.*, 2022: 48-49). In this study, various types of classification for disaster types are

investigated, and the problems of disaster classification under the current Disaster Safety Act are analyzed.

In addition, I would like to divide the existing natural disaster classification that has not been attempted yet into two categories. It would be meaningful to examine the differences and comparative benefits by dividing them into traditional natural disasters that have routinely threatened humanity for a long time in the past and natural disasters in the climate crisis caused by excessive greenhouse gas emissions, and examine their differences and comparative benefits.

2. Theoretical discussion of types of disasters

2.1. Various categories of disaster types

The term "disaster" defined in Article 3 of the current Disaster Safety Act is classified as a natural disaster and a social disaster as it can damage or cause damage to the lives, bodies, property of the people and the state. Before the revision of the law on August 6, 2013, it was classified into three categories: natural disasters, human disasters, and national infrastructure disasters, but at the time, the safety administration integrated human disasters into social disasters without in-depth professional review, resulting in failure to respond to Ferry Sewol disasters.

On the other hand, various types of disasters are classified in domestic and foreign academia. In Korea, natural disasters, human/technical disasters, and social disasters are representative (Lee Jae-eun, 2018: 218), and Lucy Jones (1993) in the United States is classified as natural disasters (smog, global warming, desertification, pollution, traffic accidents, etc.). Jones further subdivided natural disasters into geophysical and biological disasters (bacteria, diseases, etc.) and further subdivided them into geophysical disasters (earthquakes, volcanic eruptions, falls, landslides, etc.), and meteorological disasters (fog, snow, lightning, abnormal weather, etc.).

Hoetmer (1991) is divided into natural disasters, technological disasters, private disasters, and ecological disasters, and ecological disasters are mainly caused by humans, which means that they affect the Earth (Lee Jae-eun, 2018: 218). Meanwhile, Anesth (N/D) classifies disasters into natural disasters and artificial disasters, while natural disasters are classified into climate disasters such as typhoons and earthquakes, and artificial disasters are classified into accidental disasters such as explosions and planned disasters such as terrorism (Lim, 2022: 50).

The most representative disaster data base management organization, the Centre for Research on the Epidemiology of Disaster (CRED), standardized the disaster classification system, which divides disasters into natural disasters and man-made disasters: geophysical, meteorological, hydrological, climatic, biological, and cosmic. In addition, the Canadian Disaster Database (CDD) is divided into biological (epidemic), geological (earthquake, etc.), hydrological and meteorological (flood, typhoon, etc.), conflict-related (terror, etc.), and technical disasters (industrial and traffic accidents, etc.) (Im *et al.*, 2022:51).

Some scholars recognize the limitations of the disaster classification method according to the cause of occurrence and are attempting a more comprehensive classification. Among them, a representative scholar is Dynes (1970). He suggests nine criteria for the classification of disasters: frequency of occurrence, cause of occurrence, speed of progress, duration, range of impact, predictability, damage potential, controlability, and pre-signality. Based on this, research is also underway to combine this classification method with natural disasters and artificial disasters, which are classification methods according to the cause of occurrence. For example, typhoons belong to predictable natural disasters, and earthquakes are unpredictable them (Lim *et al.*, 2022: 54-55). In addition, abnormal climate phenomena are listed as examples (Kim *et al.*, 2017: 419).

2.2. Cases of occurrence by disaster type

Specific examples of human, social, and natural disasters are as follows.

First, human disasters refer to disasters caused by human carelessness, indifference, mistakes, and insufficient post-management, such as collapse of large structures, gas explosion, leakage of harmful chemicals, radioactive pollution, marine pollution, water pollution, air pollution, ozone layer destruction, acid rain and incomplete nuclear waste filling.

Second, social disaster is the threat of human life and property through religious, political, ideological, economic, and racial actions, such as war, sabotage, destruction of structural, biological and chemical weapons, cyber terrorism, a new type of the virus, rumors, violent strikes, and national infrastructure damage.

Third, natural disasters refer to disasters caused by natural disasters such as floods, torrential rains, typhoons, earthquakes, tsunamis, droughts, heat waves, cold waves, hail, tidal waves, and volcanic eruptions (Lee Jae-eun, 2018: 205-206). Considering industrial development and population concentration, future natural disasters are likely to increase their damage. In particular, natural disasters are

likely to lead to man-made disasters such as collapse and explosion, or national core-based disasters such as power and energy (Lee Jae-eun, 2018: 132).

Natural disasters are recognized as inevitable natural disasters in the occurrence of damage, making it difficult to prevent or control them, and some disasters may be predictable due to weather forecasts. In terms of damage, the beginning and end of the disaster are clear, the damage pattern is also physical, and it is easy to express the degree of damage quantitatively.

In addition, the occurrence of natural disasters affects a specific time and space, and although the influence is concentrated on vulnerable facilities and vulnerable groups according to individual social positions such as income, gender, and race, it is relatively non-discriminatory compared to other disasters (Lim, 2022: 53).

In other words, man-made disasters are caused by human mistakes, carelessness, indifference, and insufficient follow-up management, and social disasters are disasters caused by intentional and deliberate collective actions to threaten human life and property or destroy social order to achieve religious, political, and ideological purposes.

3. Understanding Climate Crisis Natural Disasters

3.1. Definition

Traditional natural disasters are disasters caused by everyday weather phenomena, such as typhoons, floods, droughts, heat waves and cold waves that are repeated periodically and seasonally. Such traditional natural disasters occur in some specific areas for a certain period of time, so the target and area of damage are limited.

On the other hand, natural disasters in the climate crisis are caused by excessive greenhouse gas (GHG) emissions by humans. It causes torrential rains and floods, extreme droughts and heat waves, severe water shortages, food shortages, large forest fires, marine acidification, sea level rise, and ecosystem collapse worldwide. If so, it should be prioritized to prove an objective causal relationship that the cause of natural disasters in the climate crisis is caused by human behavior. In response, the IPCC has consistently suggested the view that climate change has "clear human impacts" since 1990 (IPCC 1990: 80-81; IPCC, 1995: 22; IPCC, 2001: 20; IPCC, 2007: 5; IPCC, 2014: 2-8).

In particular, the sixth report published in 2021 stated, "It is obvious that the atmosphere, oceans, and land are warming due to human influences, and there are widespread and rapid changes in the air, the sea, cryosphere, and biosphere." "The increase

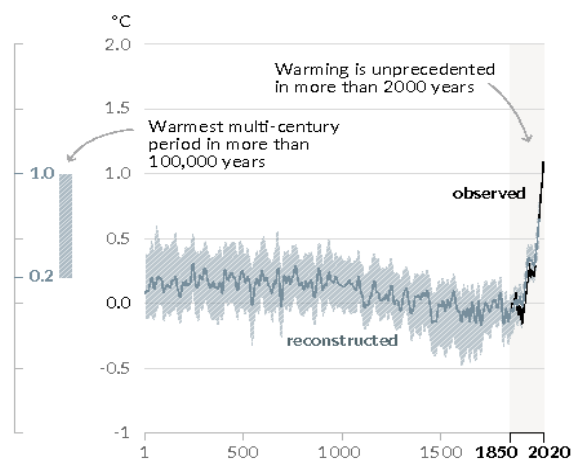
in concentration of well-mixed greenhouse gases since 1750 is apparently caused by human activity, and atmospheric concentrations have continued to increase since 2011, reaching 410 ppm in 2019 with 1,866 ppm in methane (CH₄) and 332 ppm in nitrous oxide.

The figure below is presented by the IPCC, which reveals that Human influence has warmed the climate at a rate that is unprecedented in at least last 2,000 years (IPCC, 2021: 5-7).

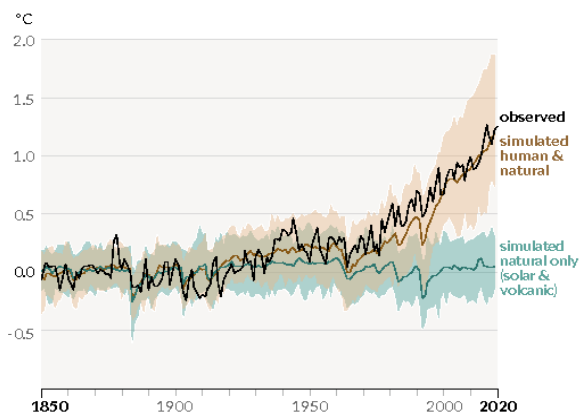
Also, in 2019, atmospheric CO₂ concentrations were higher than at any time in at least 2 million years, and concentrations of CH₄ and N₂O were higher than at any time in at least 800,000 years. Since 1750, increase in CO₂ (47%) and CH₄ (156%) concentrations far exceed, and increase in N₂O (23%) are similar to, the natural multi-millennial changes between glacial and interglacial periods over at least the past 800,000 years. Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwave, heavy precipitation, droughts, tropical cyclones and, in particular, their attribution to human influence, has strengthened since AR5. (IPCC, 2021: 10).

<Figure 1> Changes in global surface temperature relative to 1850-1900 (IPCC, 2021: 7).

a) Change in global surface temperature (decadal average) as reconstructed (1-2000) and observed (1850-2020)



b) Change in global surface temperature (annual average) as **observed** and simulated using **human & natural** and **only natural** factors (both 1850-2020)



In addition, climate change is dangerous, but the resulting depletion of biodiversity is considered a more direct and urgent risk (Choi Jae-cheon, 2021: 119), and if the current climate trend continues, one-sixth of the species on Earth could become extinct, and if climate change leads to severe sea levels, 20% of fresh water on the world's coast decreases (Park *et al.*, 26-279).

3.2 Changes in the natural environment due to human behavior (IPCC, 2021: 6).

1) Human-emitted greenhouse gases are a major factor in the warming of the troposphere since 1979.

2) The average global precipitation on land has increased since 1950, the rate of increase is likely to have increased since 1980, and the human impact is likely to have contributed to changes in precipitation.

3) Human impact has likely been a major factor in global glacial decline since the 1990s and Arctic sea ice reduction (about 40% in September and about 10% in March) between 1979 and 1988 and 2010-2019.

4) It is highly likely that human influence has contributed to the reduction of spring snowfall in the Northern Hemisphere since 1950.

5) It is highly likely that human influences have contributed to the melting of Greenland ice surface over the past 20 years.

6) It is almost certain that the upper part of the Earth's ocean has warmed since the 1970s, and human impact is highly likely to be the main factor.

7) It is almost certain that CO₂ emitted by human activity is the main cause of the acidification of the sea surface that is currently occurring globally.

8) Since the mid-20th century, oxygen levels have declined in many areas in the upper ocean, and human impact has contributed to this.

9) Between 1901 and 2018, the Earth's average sea level rose by 0.2 meter (0.15 to 0.25 m), and the

main factor is likely to be the human impact.

10) Since 1970, changes in the terrestrial biosphere have been underway with global warming, the climate zone has been moving to the both pole, and since the 1950s, the growth period in the mid-degree temperate zone has been extended up to 2 days every 10 years.

Comprehensive analysis of these results, at 1.5 °C global warming, heavy precipitation and associated flooding are projected to intensify and be more frequent in most regions in Africa and Asia, North America and Europe. Also, more frequent and/or severe agricultural and ecological droughts are predicted in a few regions in all continents except Asia compared to 1850-1900, increases in meteorological droughts are also foresaw in a few regions. A small number of regions are forecasted to experience increases or decreases in mean precipitation (IPCC, 2021: 32).

3.3 Characteristics of Natural Disasters in the Climate Crisis

Disasters caused by natural phenomena such as typhoons, floods, heavy rains, strong winds, high seas, tidal wave, heavy snow, and lightning listed in Article 3 of the Disaster Safety Act are caused by pure weather phenomena without human intervention. However, even if it is the same natural disaster, it is necessary to distinguish it from each other if the cause of the occurrence is a disaster caused by greenhouse gases induced by human behavior.

Moreover, climate-crisis natural disasters do not damage some limited areas like traditional natural disasters, but occur simultaneously across the globe. This extreme weather phenomenon is also expected to be stronger and more frequent in recent years and more widespread (Meteorological Agency, 2020.11:76; Meteorological Agency, 2020.12.:16).

In other words, extreme water shortages, abnormal temperatures that are difficult to grow crops, flooding coastal cities due to rising sea levels, food crises due to extreme droughts, large forest fires, and biodiversity collapse occur one after another, threatening life on Earth.

Thus, climate-crisis natural disasters are a threat that can cause irreparable damage to human civilization across the planet, and the climate crisis is the biggest crisis facing humans to date, with the sixth extinction of all 8 billion humans predicted since the five mass extinctions on the planet. (Paul Hokane, 2022: 456-457).

This forecast is consistent with the IPCC Sixth Assessment Report (AR6) and the Second Working Group (WG2) report, officially published by 400 experts from 195 countries around the world. This report, a determination of global collective intelligence, is based on experts opinions on climate change impact, adaptation, and vulnerability at the

55th IPCC general meeting held from February 14, 2022 to February 27, 2022. Asia is expected to increase food and water security crisis due to extreme temperatures and precipitation volatility.

In the case of animals and plants, half of the species' habitats move to high-altitude and the hilly areas, 2/3 of the plants grow faster in spring, and eutrophication is accelerated by the reduction of lake ice in the northern hemisphere. In addition, the marine life group moved about 59km north per 10 years, and as plankton decreased globally in the second half of the 21st century, fishery resources decreased by 5.7-15.5%.

The water shortage is serious. More than 4 billion people, more than half of the entire human race, are currently suffering from water shortages, but there are large regional variations, so heavy rain is expected in some areas and strong droughts are expected in others.

The food problem has a bleaker outlook. Poor food supply and demand are expected to increase, but they have failed to come up with environmentally sustainable countermeasures, and more than 10% by 2050 and 30% by 2100 will be in climate-unsuitable conditions. The urban population facing the climate crisis continues to increase mainly in Asia and Africa, and water-borne and vector-borne infections and infectious diseases are also increasing. The possibility of an increase in physical and mental disorders in mothers and infants was mentioned for the first time (IPCC, 2022: 3-35).

Climate Resilient Development, a process of implementing climate change mitigation and adaptation for sustainable development, must have governance with central, local and private participation. The reason is that the biggest victims of the climate crisis are likely to be the elderly or low-income groups, not the wealthy. In particular, climate change also causes problems related to social equity. In general, the group that causes climate change and the group that is affected by climate change tend to be inconsistent. Groups that generate greenhouse gases and promote development live less affected by climate change in safer areas based on their economic power, while groups that are relatively less responsible for greenhouse gas generation live in dangerous areas in low-lying areas and are often damaged by climate change them (Lim *et al.*, 2022: 416). In fact, of the 521 people killed in the 1995 heat wave in Texas, the United States, it was concentrated in low-income, elderly, African-American and metropolitan danger areas (Eric Kleinenberg, 2018: 60).

Factors that create vulnerable groups include economic level, ease of movement, access to information, and social ties. Typical examples of vulnerable groups are low-income, disabled, elderly, women, minority, children, single-income, medical

facility residents, correctional facility residents, homeless, foreigners and pets (Lim *et al.*, 2022: 326-332).

3.4 Types of Natural Disasters in the Climate Crisis

(1) Extreme weather phenomena

Weather phenomena caused by traditional natural phenomena such as typhoons, heavy rains, floods, strong winds, heavy snow, drought, heat waves, and cold waves are affected by global warming and the intensity becomes stronger. Extreme weather events beyond the level of traditional natural disasters to date (e.g. severe drought followed by severe torrential rain, or frequent weather events of 100 or 1,000 years occurred annually) have occurred every year. In the beginning, it comes similar to the traditional form of natural disasters, but it is increasingly difficult for humans to endure. The average temperature of the Earth will exceed 1.5°C between 2021 and 2040, and it is expected to rise to 3.3°C to 5.7°C in 2100. Just as a sudden rise in human body temperature by 2~3°C is fatal, extreme weather events occur when the average temperature of the earth suddenly rises.

The cause of this extreme weather phenomenon is human behavior. Due to excessive human greenhouse gas emissions, the atmosphere, the ocean, and the land are heating up, and extensive and rapid changes are occurring in air, sea, cryosphere, and biosphere (IPCC, 2021:5).

(2) Seawater Temperature Increase

The average temperature of seawater rose 0.88°C in the 20th century, with the ocean absorbing more than 91% of excess heat in the climate system. Since 1993, the rate of marine warming has more than doubled (IPCC, 2019: 9), and this phenomenon is expected to continue to rise in the 21st century, threatening marine ecosystems such as the disappearance of coral reefs. Marine heat waves occurred more frequently in the 20th century, and more seriously, warming is expanding to a depth of 2,000 meters (Ministry of Environment, National Center for Environmental Education. 2022: 41).

(3) Sea level rise

Due to global warming, land glaciers (ice and mountain glaciers) are melting, and sea level is rising due to thermal expansion caused by rising sea temperature. The global average sea level has risen by 20 centimeters over the past 120 years. Melting ice sheets and glaciers from 2006 to 2015 is the dominant cause of sea level rise. Tuvalu, an island country located in the center of the South Pacific, is in danger of flooding due to rising sea levels.

(4) Marine acidification

The thickened carbon dioxide in the atmosphere is dissolved in seawater, increasing the hydrogen ion concentration in seawater, changing the chemical properties of marine carbonates. This affects the growth of algae and poses a major threat to the marine ecosystem, such as reducing the ability of fish bones, crustaceans, and coral reefs (Ministry of Environment, National Center for Environmental Education. 2022: 44-47).

(5) Decrease in Glacier and Ocean Desalination

From 1992 to 2020, Greenland Ice Sheet (489 billion tons), Antarctica Ice Sheet (267 billion tons), and mountain glaciers (620 billion tons) melted, raising global sea levels. This has significantly reduced the sea ice area and thickness of the Arctic region since 1979, and this phenomenon has been unprecedented for 1,000 years. Methane (CH₄) emissions are also increasing due to rising temperatures in the Arctic and subtropical permafrost. In addition, as glaciers melt, the salt concentration of the sea is lowered and desalinated, reducing the vertical motion of seawater in which the surface water and deep water circulate. As seawater moved vertically, it was supplying oxygen to the deep sea and supplying nutrients to the underwater ecosystem, but the decrease in vertical movement of seawater is causing serious problems in the marine ecosystem. (Kim, Chu Ryung, 2021: 94-100)

(6) Decrease in biodiversity

Biodiversity plays a key role in providing food, textiles, water, energy, medicine, genetic material, etc., and is essential for controlling climate, water quality, pollination, flooding and storms, and tidal waves. Since the Industrial Revolution, the quality of life of mankind has been threatened as forests, grassland, wetlands, and other important ecosystems have been severely destroyed and devastated by human activities. Seventy-five percent of the land is already undergoing serious changes. The oceans are becoming the largest "storage" of pollutants due to chemical pollution and plastic waste, and more than 85% of ecological habitats have disappeared (Paul Hawken, 2022: 37).

A report by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) published in 2019 said 1 million species of animals and plants on Earth are endangered, with 40% of amphibians, 34% of conifers and 25% of mammals being endangered.

Due to the rise in global average temperature, the timing of full bloom of plants is accelerating, causing a decrease in produce quality, and the decrease in ecological services provided by various plants and animals such as honeybees is leading to a decrease in food production. In addition, the collapse

of the food chain, the loss of medicine, and the collapse of the ability to control climate buffers are causing great damage to human society, and ultimately directly linked to the problem of human survival (Ministry of Environment, National Center for Environmental Education. 2022: 76-77).

(7) Synthesis

Natural disasters caused by the climate crisis can be more than humans imagine in the intensity and frequency of the threat. The risks caused by climate change can be more serious and widespread as global warming intensifies. Risks in energy, food, and water sectors may overlap in time and space, and if multiple risks occur simultaneously, they may face new risks that could affect more populations and regions as exposure and vulnerability to existing risks increases. Therefore, efforts to reduce the overall risk of climate change impacts, such as the rate of global warming and maximum rising temperature limits, should be implemented simultaneously worldwide (Ministry of Environment, National Center for Environmental Education. 2022: 70). This is to reduce greenhouse gas emissions. Human beings need a disciplined mode of behavior. It is important to create a paradigm of sustainable development so that humans and nature can coexist, and the quality of life of individuals should be valued beyond material growth (Statistics Research Institute, Statistics Korea, 2022: 8).

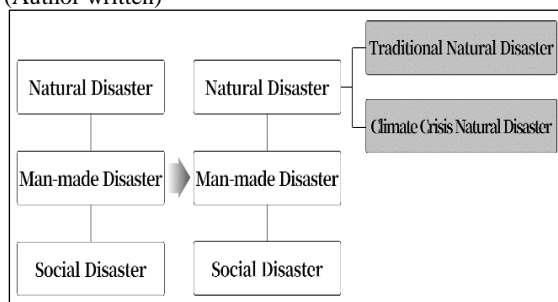
In addition, despite the advent of such a threatening crisis, the share of climate crisis in crisis management is still undervalued. This is a more dangerous phenomenon than the climate crisis. Therefore, many experts should continue to study this field in the future. From now on, there is a terrible hypothesis that the sixth target of extinction is humans, following the mass extinction of dinosaurs that occurred 65 million years ago in the Cretaceous Period of the Mesozoic Era. If all mankind does not jointly reduce greenhouse gases, the ultimate victim of the climate crisis is humans.

3.5 New Classification and Benefits of Natural Disasters

As we have seen so far, in addition to traditional natural disasters caused by pure weather phenomena, there is another natural disaster caused by human behavior, that is, climate-crisis natural disasters, and their risks are incomparably threatening. However, due to weak research on classification systems and responses, Lucy Jones (1993) included global warming in "Quasi-Natural Disaster" (Lim *et al.*, 2022: 51), and Hoetmer classified natural disasters affecting the Earth by humans as ecological disasters, and it is still difficult to find a study in Korea.

Disastronomy¹ is a study aimed at respecting and implementing the universal values of human life, human dignity, and human fundamental rights by finding laws and rules to overcome and manage the nature and causes of disasters. Therefore, knowing the exact cause of the disaster can be consistent with the direction pursued by Disastronomy. The competition and increase in discussion of crises and disasters is the best way to add depth to the area of this field. (Lee Jae-eun, 2018:42).

<Table. 1> New Classification of Natural Disaster (Author written)



The theoretical framework of crisis management policy can be largely divided into crisis management strategies and crisis management processes. Crisis management strategies can be divided into prevention strategies and restoration strategies focusing on theoretical discussions on risks and uncertainties, and the crisis management process can be divided into four stages: prevention, preparation, response, and recovery based on the time of disaster. Here, it is important to come up with the best measures that humans can do in climate crisis situations by interconnecting the prevention strategy of crisis management and the prevention and preparation of crisis management processes, focusing on the prevention of natural disasters.

In addition, the prevention strategy as a crisis management strategy refers to predicting potential threats and making preventive efforts to prevent them in advance. It also refers to activities that eliminate crisis triggers or suppress or prevent crisis factors from being expressed before a crisis actually occurs (Lee Jae-eun, 2018: 140-147)

Therefore, humans have not played much role in preventing natural disasters so far, but if natural disasters are divided into traditional natural disasters and climate-crisis natural disasters, there are many things humans need to do to prevent them. Since seasonal and local traditional natural disasters are

caused by simple weather phenomena without human behavior, there is a perception that it is difficult to control and regulate human actions to prevent them.

(Lim *et al.*, 2022:51). However, since natural disasters in the climate crisis are the cause of human behavior, if human behavior is not controlled and managed, the intensity of natural disasters increases. As for the control and management methods, various methods such as revision of relevant laws and establishment of a control system to eradicate acts that cause climate crisis natural disasters, regular education and publicity, raising awareness, and imposing fines should be mobilized. In addition, since climate-crisis natural disasters vary widely, it is necessary to respond carefully to them by region, age, gender, and class, and to make them feel proud to act for climate change (George Marshall, 2022: 334).

In this way, attempting a new classification of natural disasters and analyzing the causes are positively beneficial to induce the development of Disastronomy.

4. Conclusions and Implications

In proportion to the brilliant development of mankind, various disasters are constantly occurring, and their patterns and sizes are becoming more complex and larger, so the more detailed and sophisticated the mindset and attitude we usually deal with disasters is. As the concentration of greenhouse gases in the air increases, the temperature of the atmosphere and the ocean rises, and the amount of snow and glaciers decreases, and global warming is clearly progressing with rising sea levels and ocean acidification.

It is clear that greenhouse gas emissions from human activities warm the earth, and climate change is occurring extensively and rapidly in the atmosphere, oceans, ice zones, and biosphere. This is unprecedented in the scale and many aspects of recent changes across all climate systems for hundreds to thousands of years.

Climate change caused by human movement is already affecting extreme weather in many parts of the world. Since the 1950s, climate change has increased the frequency and intensity of extreme temperatures such as heat waves in most areas, and heavy rain on land (Ministry of Environment, General Information Center of greenhouse gases, 2022: 40-41)

As mentioned earlier, academia classifies various

¹ The Study of realizing respect for human life by finding the nature and cause of disasters, finding rules for overcoming them and managing them (Lee Jae-eun, 2018: 42).

types of disasters, and when classified by the cause of disasters, there is a difference between natural disasters and human and social disasters caused by human actions. However, if natural disasters are classified as traditional natural disasters and climate-crisis natural disasters, disasters caused by pure weather phenomena are only traditional natural disasters, and disasters caused by human actions include climate-crisis natural disasters, social disasters, and human disasters.

It is very important to accurately identify the cause of a disaster, and depending on what type of disaster it is, risks or threats have qualitative differences. Therefore, not only should the crisis response be different for each type of disaster, but also the management method should be different (Lee Jae-eun, 2018: 149). It is also necessary to respond to the crisis by establishing a disaster management plan in consideration of climate change and strengthening various design standards suitable for the climate crisis (Fire and Disaster Prevention Agency, National Disaster Prevention Research Institute, 2005: 126-128). In recent years, more serious levels of natural disasters have occurred frequently than in the past, and strictly speaking, the initial form of climate-crisis natural disasters can take the form of traditional natural disasters. However, since there is a difference in the cause of occurrence, and the target and scope of damage are global, the response method should be different.

In particular, in the case of traditional natural disasters, there is not much way to eliminate the cause of occurrence, but I think the benefits of classification are sufficient because the climate-crisis natural disasters can greatly reduce damage according to various human efforts. Currently, various studies are being conducted on the classification of disaster types in the United States, and it is meaningful to subdivide existing natural disasters into climate-crisis natural disasters as there are practical benefits to reduce damage through the materialization of natural disasters caused by climate change (Song Min-sun, May 14, 2022).

In addition, traditional natural disasters occur in one country or in some areas, but climate-crisis natural disasters occur simultaneously around the world, so it is urgent to establish a systematic international cooperation system more than just sharing weather information. In order to solve the problem of climate crisis, various subjects across borders must make integrated efforts to reduce carbon emissions. The issue of climate crisis can be said to be a global collective action problem. Since the threat caused by climate crisis is the result of various subjects such as individuals, groups, and countries, a solution is required at the international level.

Regardless of whether the responsibility for global warming is large or small, consensus action at the international level is essential for all countries to reduce the impact of climate change. In addition, responsible attitude of developed countries that emitted excessive greenhouse gases from the beginning of the industrial revolution is needed, and it is most important to solve this problem together through technical support and assistance to developing countries. The climate crisis is not a problem for one country, but for all countries. Resolving the climate crisis is impossible with one country's efforts, and a high level of international cooperation is required. There are two types of international cooperation. The first is to minimize the damage from the climate crisis and strengthen resilience through "International Cooperation of Mitigation," mainly in the form of advanced countries supporting developing countries. The second is 'adaptive international cooperation'. It is to work together to reduce greenhouse gas emissions together (KEI, 2021: 274-301).

The Jenga game, designed by British board game designer Leslie Scott in 1983, is similar to the Climate Crisis situation. First of all, small signs of both occur continuously, but the overall shape remains undisturbed until the decisive moment arrives. In other words, very small and minute imbalance factors continue to repeat and accumulate, and at one point, the entire shape collapses. This moment is called a tipping point. The tipping point refers to "a phenomenon that slowly progresses and then the balance is broken at an instant due to small factors."

Earth's surface temperature has now risen by 1.09°C compared to pre-industrial (1850-1900), and the IPCC's sixth assessment report warns that if greenhouse gas emissions continue as they are, they will reach 1.5°C between this year and 2040. We haven't reached the tipping point yet, but this is slowly approaching. Every year, small changes and signs of abnormal weather continue to appear around us, but no decisive breakthrough changes have occurred yet. However, many experts point out that the abnormal weather we are experiencing now will break the balance across the globe. It's too late when you realize that moment has come, This is why it should be thoroughly prevented in advance to prevent the climate crisis from occurring.

References

- Cho, Cheon Ho. 2021. The need for carbon neutrality 2050. *Climate Change and Green Growth, 2021 Summer Issue Presidential Issue* 21: 6-13.
- Choi, Jae Cheon. 2021. Ecological transformation, For a Wise Life on Earth. Gyeonggi: Kim young-sa.
- Chungbuk Policy Development Center. 2021. Greenhouse gases in Chungbuk at a glance North Chungcheong Province.

-
- Eric Kleinenberg. 2018. Heat wave society, Gyeonggi : A writing jar.
- Fire and Disaster Management Agency, National Disaster Management Institute. 2005. A study on how to cope with natural disasters in response to climate change.
- George Marshall. 2022. The psychology of climate Change. Seoul: Galma Breeze.
- IPCC. 1990. Climate Change: The IPCC 1990 and 1992 Assessment. WG1. SPM. 80-81
- IPCC. 1995. IPCC Second Assessment Climate Change 1995. WG1. SPM. 22.
- IPCC. 2001. TAR Climate Change 2001: Synthesis Report. SPM. 20.
- IPCC. 2007. Climate Change 2007: Synthesis Report. SPM. 5.
- IPCC. 2014. AR5 Synthesis Report: Climate Change 2014. SPM. 2-8.
- IPCC. 2019. Summary for Policymakers. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Portner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (eds.)]. In press. 9.
- IPCC. 2021. Climate Change 2021: The Physical Science Basis. WG1. SPM.
- IPCC. 2022. Climate Change 2022: Impacts, Adaptation and Vulnerability. WG2. SPM. 3-35.
- KEI. 2021. Korea Carbon Neutrality 2050. Seoul: A crayon book.
- Kim, Chu Ryung. 2021. *Tomorrow's Earth*. Seoul: Red Salt.
- Kim, Eun Ryeong. 2020. Rachel L. Carson. 1962. Silent spring. Seoul: Eco-ribre.
- Kim, Ha Yeon & Lee, Jung Il. 2017. Safety management theory. Seoul: Book Publishing Tuesday Wednesday Thursday.
- Kim, Jung In. 2021. ESG Linkage Plan for Achieving Carbon Neutrality Climate Change and Green Growth, 2021 *Winter Issue* No. 22: 16-30.
- Korea Meteorological Administration (KMA). Nov. 2020. Climate Change Science Glossary. Seoul: Climate Change Monitoring Division.
- Korea Meteorological Administration (KMA). 2020. Korea Climate Change Assessment Report 2020, Scientific Rationale for Climate
- Korea Meteorological Administration (KMA) (Dec. 2020). Special Report on Global Warming at 1.5°C. Seoul: Climate Change Monitoring Division.
- Korea Meteorological Administration and the National Institute of Meteorological Sciences (2021). Report on Climate Change Analysis in Korea 109 (1912-2020). Seoul: Climate Change Surveillance Division, National Institute of Meteorological Sciences Future-Based Research.
- Lee, Mi Yeon. 2020. Analyzing the financial requirements of supporting natural disasters in consideration of climate change: focusing on disaster support funds and storm and flood insurance. *Korea National Assembly Budget Policy Research* Vol.9, No1, p28-60.
- Lee, Jae Eun. 2018. *Crisisonomy*. 2nd. Seoul: Daeyoung-munhwa-sa.
- Lim, Hyun Woo & Yoo, Ji Sun. 2022. Disaster Management Theory. 2nd. Seoul: Park young-sa.
- Ministry of Environment. 2020. Korea Climate Change Assessment Report 2020, *Climate Change Impact and Adaptation*.
- Ministry of Environment, National Center for Environmental Education. 2022. 2050 Carbon Neutral Education Reference Collection. Gwang-moon printing company.
- Ministry of Environment, General Information Center of greenhouse gases. 2022. 2021 national greenhouse gas inventory report.
- Park, Hoon. 2021. The climate change data book for a sustainable future. Seoul: Academy of Social Criticism.
- Park, Young Sook and Jerome Glenn. 2017. World Future Report 2050. Seoul: Business Books.
- Paul Hawken. 2022. Regeneration ending the climate crisis in one generation. Gyeonggi A writing jar science.
- Song, Min Sun. 2022.5.14. Sat. 5:50pm. Chungbuk National University School of Social Sciences N15-450. "Currently, various studies are being conducted in the United States on the classification of disaster types, and it is meaningful to subdivide existing natural disasters into climate-crisis natural disasters."
- Statistics Research Institute, Statistics Korea. 2022. SDGS in the Republic of Korea: Progress Report 2022.

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