

# North Korea's Climate Change Challenges and the Need for International Cooperation

Dawool Kim Associate Research Fellow, Int'l Cooperation for Korean Unification Team, Center for Area Studies (dww129@kiep.go.kr)

## I. Introduction

North Korea recognized the importance of addressing climate change early on and has been an active participant in international cooperation on climate change. It joined the United Nations Framework Convention on Climate Change in 1994 and has also participated in the Kyoto Protocol and the Paris Agreement. In 2000 and 2012, the DPRK submitted its National Communications on Climate Change to the UNFCCC, reporting on climate change impacts, adaptation measures, and greenhouse gas generation and reduction plans. Domestically, North Korea is also making efforts to reduce disaster risk by developing a National Disaster Risk Reduction Strategy in 2019 and drafting related legislation. However, North Korea's vulnerability to climate change is still considered to be very high, and the country has been largely unable to participate in the inter-

national community's efforts to support climate change adaptation in developing countries due to sanctions.

Under these circumstances, this study aims to identify the need for cooperation on climate change adaptation by analyzing the impacts of climate change with a focus on natural disasters and agriculture. For this purpose, we not only refer to domestic and international statistics, literature, and media data, but also use real-time satellite data to provide empirical evidence on climate change impacts and policy performance in North Korea. We also emphasize the need to support North Korea's adaptation to climate change and suggest that South Korea should consider joining the international community in supporting North Korea's climate change adaptation efforts.

## II. Impact of Climate Change on North Korean Agriculture and Natural Disaster

### 1. Climate Change in North Korea

The phenomenon of climate change is characterized by changes in the mean and variability of climate characteristics, and since these changes occur over a long period of time, they are usually observed through changes in long-term mean values. Table 1 shows the changes in the decadal mean values of climate characteristics in North Korea. The mean annual temperature in North Korea increased from an average of 8.7°C in 1991-2000 to 9.0°C in 2011-20, an increase of 0.3°C in 20 years.

The climate change trend is even more pronounced when looking at the seasons. Average temperatures in spring, summer, and fall increased by about 0.6-0.8°C from 1991-2000 to 2011-20, while average temperatures in winter

decreased by 0.4°C over the same period. This trend of increasing average temperatures and increasing climate variability has led to a decrease in average winter temperatures and a significant increase in spring, summer, and fall temperatures. This trend is also reflected in changes in maximum and minimum temperatures, with spring maximum temperatures increasing from 14.2°C in 1991-2000 to 15.4°C in 2011-20, an increase of 1.2°C in 20 years.

Precipitation is also increasing rapidly, with summer precipitation increasing from 472 mm in 1991-2000 to 630 mm in 2011-20. Similar to South Korea, North Korea's precipitation is concentrated in the summer, and this increase in summer precipitation can increase the likelihood of flooding. Fall precipitation has also increased significantly, from 167 mm in 1991-2000 to 199 mm in 2011-20. Fall precipitation is mainly due to typhoons, indicating that the impact of typhoons is increasing.

**Table 1. Trend in North Korean Climate Characteristics**

(Unit: °C, mm)

Climate Characteristics	Period	Year	Spring	Summer	Autumn	Winter
Average Temperature	1991~2000	8.7	8.2	21.3	10.2	-5.1
	2001~2010	8.9	8.6	21.5	10.7	-5.2
	2011~2020	9.0	9.0	21.9	10.8	-5.5
Maximum Temperature	1991~2000	14.2	14.2	26.2	16.1	0.4
	2001~2010	14.5	14.6	26.3	16.7	0.4
	2011~2020	14.9	15.4	27.0	16.9	0.3
Minimum Temperature	1991~2000	3.9	2.8	17.4	5.1	-10.0
	2001~2010	4.1	3.2	17.6	5.7	-10.2
	2011~2020	4.0	3.2	17.9	5.7	-10.6
Precipitation Level	1991~2000	825.8	143.7	472.4	166.6	44.4
	2001~2010	888.5	143.7	525.0	176.4	42.6
	2011~2020	1018.8	142.8	629.8	199.3	46.7

Source: Kim et al. (2022), p.27.

## 2. Natural Disasters

Natural disasters are becoming more frequent in North Korea as climate change leads to greater climate variability and more extreme weather. According to the EM-DAT international disaster statistics published by the Center for Research on the Epidemiology of Disasters (CRED), North Korea experienced 41 natural disasters between 1991 and 2020, an average of 1.3 per year. However, EM-DAT statistics do not cover all natural disasters in North Korea, as they only identify disasters as those that result in 10 or more deaths, affect 100 or more people, result in a declared state of emergency, or result in a request for international assistance.

Kang et al. (2021) examined North Korea's natural disasters through a literature review of North Korean media and academic journals, domestic and international media reports and publications, and publications of charitable organizations and international disaster-related organizations. The study found that the frequency of floods, typhoons, droughts, and heat

waves in North Korea from 1991 to 2020 totaled 92 events, which is more double the EM-DAT statistics and corresponds to an average of 3.1 natural disasters per year. Table 2 shows the occurrence of natural disasters by type in both statistics.

According to Kang et al. (2021), floods were the most frequent type of natural disaster, with 41 floods and 27 typhoons, accounting for 73.9% of the total. Furthermore, the frequency of wind and water disasters has more than doubled from 8 floods and 6 typhoons in the 1990s to 20 floods and 13 typhoons in the 2010s. This increase in the frequency of wind and water disasters is believed to be due to the fact that typhoons and precipitation in North Korea, like in South Korea, are concentrated during the summer rainy season, but effective prevention has not been achieved due to lack of infrastructure and inadequate response systems. Droughts, meanwhile, occurred 17 times about once every two years. Heat waves were relatively rare, occurring seven times between 1990 and 2020.

**Table 2. North Korea Natural Disaster Events (1991-2020)**

Category	1991~2000		2001~2010		2011~2020		Total	
	Kang	EMDAT	Kang	EMDAT	Kang	EMDAT	Kang	EMDAT
Flood	8	6	13	11	20	9	41	26
Typhoon	6	3	8	3	13	4	27	10
Drought	7	0	2	0	8	4	17	4
Heatwaves	3	0	1	0	3	1	7	1
Total	24	9	24	14	44	18	92	41

Source: Kim et al. (2022), p.29

EM-DAT statistics show the number of deaths, victims, and in some cases the amount of damage caused by the disaster. [Table 2-5] shows the average damage by type of natural disaster. The number of victims and deaths from famines during the March of Hardship, a compound disaster, is for the period 1996-2001, with an estimated 610,000 deaths and 8 million victims. The famines of this period were the result of a combination of economic hardship and successive droughts and floods, and are difficult to attribute to a specific type of natural disaster.

When comparing the direct damage caused by individual disasters, excluding the effects of famine, floods appear to cause the most deaths. Of the 26 floods recorded in EM-DAT statistics for the period 1991-2020, seven resulted in more than 100 deaths, with the 2007 and 2016 floods causing 610 and 538 deaths, respectively. All but two of the 10 typhoons in North Korea also resulted in fatalities. Victimization is the number of people directly affected by a disaster, including casualties and displaced persons. Floods affected an average of 540,000 people and typhoons affected an average of 750,000 people, with Typhoon Lingling in 2019 causing a massive 5.3 million victims. These statistics suggest that floods and typhoons have repeatedly caused massive casualties in North Korea, and that there is an urgent need to improve response capabilities to reduce casualties from natural disasters.

On the other hand, the average number of victims of droughts is much larger than that of floods and typhoons. The frequency of droughts recorded in EM-DAT statistics is low, with a total of four droughts in 1991-2020, but the number of victims reached 3 million in 2012, 18 million in 2015, and 10.1 million in 2019. Because droughts reduce agricultural production and exacerbates North Korea's chronic food shortages, they appear to have a greater impact than floods or typhoons, which cause more localized damage. However, droughts have not led to fatalities, with the exception of a famine in the mid-1990s that followed a series of floods and droughts.

Monetary damage estimates are available for only 15 of the 41 natural disasters. The averages are \$1,958 million for floods and \$1,023 million for typhoons, but this is more a reflection of a few high-profile events than a generalization. Excluding the \$15 billion in damages from the 1995 floods, \$6 billion from Typhoon Phra Phirun in 2000, and \$2.2 billion from the 1996 floods, the average flood caused \$61.25 million in property damage and the average typhoon caused \$27.83 million. Given North Korea's 2021 budget of \$91.2 billion and the fact that the 1995-96 and 2000 losses were beyond recovery without outside assistance, the average property damage is also a significant burden on the North Korean economy.

**Table 3. Damages by type of natural disaster in North Korea**

Category	Frequency	Average number of victims	Average number of fatalities	Average amount of damage (mil. USD)
Complex Disaster: Famine	1	8,000,000	610,000	-
Flood	26	546,474	130	1,958 (61.3) *
Typhoon	10	753,711	29	1,023 (27.8) *
Drought	4	10,366,667	-	-
Heat Wave	1	13,768	-	-

Note: \* Value in the parentheses indicate the average losses, excluding outliers such as the 1995 and 1996 floods and the 2000 typhoon.

Source: Kim et al. (2022), p.33

### 3. Extreme climate impacts on Agriculture

In order to assess the impact of climate change, rising extreme weather events, to be specific, we empirically analyzed the impact of extreme weather events on North Korean rice and corn production. Since the data availability on agricultural production is very limited, we used satellite data, MODIS NDVI of North Korean rice paddy and field area, to proxy the level of agricultural production. We investigated the impact of drought, flood, and heat wave on the growth stage of each crop using a fixed effect model at the county level.

To summarize the results of the empirical analysis, rice productivity is negatively affected by heavy rainfall during the growing and sowing season and drought during the preparation season and growing season, while corn productivity is negatively affected by heavy rainfall during the growing season and drought during the sowing and harvesting season. Considering these results and the climate

characteristics of North Korea, it is expected that the agricultural damage caused by drought in spring and heavy rain in summer is large and is likely to increase.

Extreme weather events have a negative impact on a country's agriculture, but they don't in and of themselves mean that food supplies will be compromised. In general, countries are able to compensate for food shortages through trade. North Korea's food self-sufficiency rate, which is the ratio of production to minimum food requirements, is in the range of 70-80%. Moreover, North Korea imported very little food from abroad in 2020 and 2022. Since imports and foreign aid were sharply reduced due to COVID-19 and sanctions, it is likely that the country's food self-sufficiency rate was close to 100%. Since food is not a sanctioned commodity, food imports have resumed with the post-pandemic transition and resumption of trade, but it is possible that grain imports will not be as high as needed due to sanctions-imposed foreign currency earnings constraints.

This extremely high level of self-sufficiency

is expected to make North Korea paradoxically more vulnerable to external factors such as extreme weather. This is because countries like North Korea that are less able to cope with extreme weather events are more likely to experience food shortages as a result of climate change. South Korea, for example, has a food self-sufficiency rate of about 50 percent, which is lower than North Korea's, but it can still meet its food needs by relying on imports. However, due to the difficult internal and external conditions, North Korea's ability to cope with food shortages is likely to be weaker than South Korea's.

### III. Policy Implications

Climate change phenomena and impacts are already a visible risk in North Korea, and improving adaptation is essential. Moreover, as South Korea shares a natural environment with North Korea, North Korea's failure to adapt to climate change can have a direct impact on South Korea. A case in point is the unauthorized release of water from a dam upstream of the Imjin River in North Korea during the rainy season, which puts South Korean territory downstream of the Imjin River at risk of flooding.

The United Nations Environment Programme (UNEP) has pointed out that climate change interacts with political, social, and economic conditions and can have security implications when combined with existing tensions. North Korea has already experienced this during its hardship march in the 1990s, when a

series of droughts and floods coinciding with the collapse of the Soviet Union led to a severe economic crisis and famine, and it will affect the country and regional stability if such a crisis recurs in the future due to intensified climate change. As a member of the global community to combat climate change, and for our own benefit, it is necessary to help North Korea mitigate climate change and increase its adaptability to climate change.

Unfortunately, environmental cooperation between the two Koreas is not sustainable. Comprehensive sanctions have drastically reduced the scope of possible inter-Korean cooperation, and North Korea's continued nuclear development and armed provocations have strained inter-Korean relations, shrinking space for inter-Korean cooperation.

Cooperation with North Korea through the international community can be an effective way to carry out cooperation on climate change adaptation in this situation. Many European countries and the EU, as well as international organizations, have called for the implementation of sanctions and condemned North Korea's armed provocations while continuing to cooperate with North Korea. This has been possible because the consistent relationship has built trust between them and development cooperation, which focuses on humanitarian aid, has not been linked to security issues.

The South Korean government cooperates with the international partners in providing assistance to North Korea, but the channels are

limited to international organizations such as WFP, UNICEF, etc. The Humanitarian Country Team (HCT), which has a permanent office in North Korea and manages international cooperation projects, includes not only international organizations but also a number of international NGOs and the International Federation of Red Cross and Red Crescent Societies. The international NGOs that are part of the EUPS have been working with North Korea for more than 20 years and have accumulated trust and know-how in working with North Korea, as well as local access through their permanent offices in North Korea. Supporting North Korea through these organizations, along with international organizations, can be an effective way to support climate change in North Korea in situations where direct cooperation between the two Koreas is difficult.

Consideration could also be given to implementing joint cooperation projects with countries that are actively engaged in supporting North Korea. As in the case of general ODA, where many donor countries work together, the South Korean government could establish regular channels of communication channels with national organizations that continue to provide assistance to North Korea, such as the EU and Switzerland, and explore joint cooperation projects.

Utilizing international organizations and conventions to which the two Koreas are members could also be an option for cooperation by the international community. North Korea is a member of the UNESCAP/WMO Typhoon

Committee, attending its regular meetings, and actively participates in the International Conference on Disaster Risk Reduction organized by the UN Office for Disaster Risk Reduction (UNDRR). It is a party to all major environmental agreements, including the Paris Agreement, the Convention on Biological Diversity, the Convention to Combat Desertification, and the Ramsar Convention. These international agreements on the environment and climate change encourage international cooperation to help developing countries implement them. For example, the 2015 Sendai Framework includes support for international cooperation to implement the Code in developing countries as one of the seven goals to be achieved by 2030. Organizing seminars on climate change adaptation with member states, including North Korea, on the sidelines of regular meetings of environmental conventions could be a start.

Consideration could also be given to leveraging financial resources for the implementation of international agreements. For example, the Green Climate Fund (GCF) and the Global Environment Facility (GEF) were established to support the development of nationally determined contributions and the implementation of adaptation plans by parties to the UN Framework Convention on Climate Change. In 2019, the GCF approved a capacity-building project with FAO as the implementing agency to support North Korea's response to climate change, but the project has not been implemented or disbursed. Identifying barriers

to the implementation of GCF projects and improvements for the smooth use of climate finance, and proposing climate change adaptation cooperation projects through the GCF could be a way to support climate change adaptation in North Korea with the international

community. In order to effectively support North Korea's climate change adaptation, it is important to explore partners and platforms for cooperation at the broader international level and to engage with the international community. **KIEP**

## Reference

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