
Environmental Pollution in North Korea and Inter-Korean Cooperation

Soon-jick Hong*

Introduction

Since North Korea lags far behind South Korea in industrial development, and the population density and degree of urbanization in North Korea are both very low, it is widely believed that the North Korean environment is less polluted than that of South Korea. Taking advantage of this assumption, North Korea has launched a propaganda campaign claiming that it has created a utopia on earth, free of environmental destruction and pollution, where "people are so youthful at sixty; that wait until their ninetieth birthdays to celebrate 'Hwangap,' the special celebration on one's sixtieth birthday."

Is North Korea truly such a utopia, free of environmental destruction and pollution as it claims? Unfortunately, it is very difficult to evaluate the true environmental situation, since not only is access to relevant information restricted, but field surveys and observations to measure the degree of North Korean pollution are also prohibited. Furthermore, quantitative long-range studies as well as other statistical information about North Korea are almost nonexistent. Thus, we can only make an indirect assessment of the

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* Hyundai Research Institute

real situation through the accounts of North Korean defectors, visitors to North Korea, and the ideological public addresses of Kim Il-sung and Kim Jong-il, that encourage environmental preservation, or some North Korean films and economic reports. This information depicts a totally different picture from that of the North Korean propaganda; instead showing that the country's environment is in a critical state; the forests are being destroyed, and air, water, and soil are being severely polluted; and the ecosystem having been partly damaged by overhunting. Furthermore, the issue of Taiwan's planned shipment of low-level nuclear waste to North Korea in 1997 still looms, raising concerns that North Korea could again try to earn foreign currency at the cost of environmental degradation.

The effects of pollution in North Korea will not be limited to its own borders. Pollution does not respect national boundaries, and can seriously affect neighboring countries, including South Korea. Moreover, Pollution will only add to the burden of unification costs after the reunification of the Korean peninsula. The necessity and importance of cooperation between the South and the North to preserve the environment is paramount, since the Korean peninsula is the sole habitat for all Koreans now, and for future generation. There is a need to recognize that the pursuit of cooperation between the South and the North to preserve the environment will reap positive benefits; expansion of economic cooperation between the South and the North, North Korea's participation as a responsible member in the international community as well as creation of a positive for reunification in the long-term.

In this study, the current environmental situation and the causes of pollution in North Korea will be examined, then the types of long-term and short-term approaches that South and North Korea should take, and the methods that should be adopted to prevent pollution and to preserve the environment on the Korean peninsula will be outlined.

North Korea's Environmental Pollution

North Korean authorities extol the safety and pollution-free state of the country. Furthermore, North Korea has emphasized the

importance of environmental preservation in view of the management of its socialist utopia.

Environmental issues have been raised by some scholars since the 1970s when the level of industrial pollution became serious owing to the construction of heavy chemical industrial complexes, the expansion of the scale of industry, and reckless development of mineral resources. Yet, North Korea showed no interest in the environment at the policy level until the implementation of various policies for the prevention of pollution and environmental preservation under the "Law of Environmental Protection" established in the 5th plenary session(April 9, 1986) of the 7th-term Supreme People's Assembly. This law can be regarded as the beginning of the second term¹ of North Korean Environmental Policy.

In 1992, North Korea stipulated "Countermeasures for Environmental Preservation Prior to Production" in its constitutional amendment(Article 57). Subsequently, in preparation for attracting foreign capital and technology associated with opening its markets, North Korea improved the law on pollution prevention as an extension of its foreign investment laws.² In February of 1993, North Korea established the "State Environmental Protection Commission," a non-standing organization, under the auspices of the Administration Council. In September 1996, North Korea established the State Environmental Protection Bureau and recently demanded full implementation of "Enforcement Decree of the Environmental Protection Law"(Chapter 5, Article 55) established by the Administration Council in November 1995. In November 1996, October 23rd was designated as "National Land Protection Day" by the government ordinance of the Central People's

¹ North Korean environmental policy can be divided into two periods. The first period is from the 1945 Liberation of Korea to the year 1977 when the "Land Law"(April 29, 1977) was enacted and the second period, from the legislation of the "Law of Environmental Protection"(April 9, 1986) to the present. North Korea had only begun to notice the importance of the environment during the initial period. In the second period, it has attempted to find technological solutions to environmental issues, urged scientific modernization, and proposed the necessity of legislation. Son Ki-woong, "North Korean Environmental Policy and Environmental Condition," *Korea Journal of International Relations*, 35:2, 1995, pp. 175-193.

² The Foreign Investment Law in 1992 and regulations for operation of the Joint Venture Law, the Free Economic Trade Zone Law and the Leasing of Land Law in 1993, and operation regulations of foreign companies and free trade regulations are good examples of regulations related to environmental pollution.

Committee. As for its foreign policy, North Korea entered the World Conservation Union(IUCN), in May 1993. It has also participated in the United Nations Environment Programme(UNEP) since 1992. In June of 1993, a national celebration was held in Pyongyang, marking World Environment Day.

However, according to a recent report, North Korea's situation seems to be different from what the North Koreans claim. Considering the ongoing food shortages, solving the environmental issue seems self-indulgent and unattainable. The North Korean region has seen red tides and withered crops, as well as the destruction of the ecosystem, and water pollution, all side-effects of severe environmental pollution. As a result, many people are suffering from all types of diseases including dermatitis and respiratory ailments. In North Korea, capital and technology for the preservation of the environment are in short supply and the pollution-producing industries such as coal/mineral mines and metal/chemical factories are not equipped to deal with pollution prevention.

Atmospheric Pollution

Atmospheric pollution has reached a critical point in major industrial cities of North Korea, especially in Hyungnam, Hamhung, Chongjin, Wonsan, and Sinuiju in the East Sea industrial zone. For example, in the Hungnam district of Hamhung city, 70% of which is an industrial area, there is such a serious atmospheric problem that people cannot make out an object within 1 km on a clear day. The atmospheric problem is believed to have resulted from exhaust gas emissions from Pongung chemical factory, Hungnam ironworks, February-8th vinalon factory,³ and Hungnam fertilizer plant. Mrs. Yeo, wife of Mr. Yeo Man-chol, a well-known North Korea defector to the South in 1994, testified that the quality of air of Hamhung was worse than that of Seoul.⁴ According to report, in Wonsan, the site of the Wonsan chemical plant and Mungyung refinery, residents suffer from bronchitis, phthisis, and

³ Vinalon, a synthetic fiber developed in North Korea and made from limestone and anthracite, has played an important role in meeting textile demands in North Korea.

⁴ *The Chosun Ilbo*, May 19, 1995, p. 5.

dermatitis. In addition, workers in those plants have exhibited strange symptoms, including tooth loss.⁵

Residents of the Chungjin district suffer from respiratory diseases owing to the exhaust gas and carbon bisulfide fumes from Kimchaek refinery and the Chungjin chemical textile plant. According to the testimony of defectors, in Byulodong, the site of the Woonha plant, which produces liquid chemical fuel, 10 thousand people, 40% of the liver, and liver cancer.

Given North Korea's unique geographical characteristics of mountainous regions and basins, its industrial areas would most likely be affected severe atmospheric pollution, including regional acid rain, especially in the western industrial areas Nampo, Songrim, Sariwon, and Haeju, where iron refinery plants are located.⁶ The sulfurous acid and nitric acid gases are known to react with oxygen in the air to produce a nitrogen oxide and sulphuric acid compound, which become acid rain when they combine with moisture. According to a recent report of RAINS-ASIA (the Regional Air Pollution INformation and Simulation - ASIA) project concerning the acid rain in Asia, oxidized gas produced in Korean peninsula is causing acid rain not only in the region but in the neighboring countries of China and Japan.⁷ The Hayes research team estimated that the amount of sulfurous acid gas in North Korea in 1990 was three times higher than that estimated by RAINS-ASIA team.⁸

The use of coal as a main source of energy and the auxiliary use of petroleum, have contributed to the increase of greenhouse gases

⁵ Naewoo Press. "Is Environmental Protection Going Well?" no. 1101, Weekly-version.

⁶ Concrete data on acid rain in North Korea is insufficient, but according to a report, Mt. Baekdu produced strong acid rains of ph. 4.6. Jung Yong-seung and Kim Tae-gun, "Study on the Origin of Acid Rain Observed Near the West Sea of South Korea," *Journal of Korea Society for Atmospheric Environment*, 1991, pp. 203-207; Jung Yong-Seung et al., *Research on North Korea Weather and Air Quality*, Korean Federation of Science and Technology Societies, 1992.

⁷ In 1990, major producers and receptor-countries of sulfuric acid sediment in Northeast Asia are China, South Korea, North Korea, and Japan. China produces 776,600 tons of sulfuric acid sediment each year; South Korea 51,397 tons; North Korea 15,244 tons and Japan 38,728 tons. L. Horcijk et al., *An Assessment Model for Acid Rain in Asia*, Unpublished work, RAINS-ASIA project; Peter Hayes, David Von Hippel, and Yun Duk-ryong, "Ecological Crisis and Quality of Life in North Korea," *Searching for an International Environment for the Peaceful Co-existence of the Two Koreas*, November 17, 1998, the 4th Regular Academic Meeting of Unification Research Institute in Yonsei University, p. 29, quotation.

⁸ Hayes et al., op. cit., p. 6.

in the air, the biggest cause of environmental pollution. The increase of greenhouse gases leads to a number of negative results including an increase in regional and global temperatures, increasing the amount of chemical precipitate, creation of abnormal weather, an raising of the sea level. According to a study by the International Energy Agency and Organization for Economic Cooperation and Development (IEA/OECD) on the production of carbon dioxide, methane, and nitric acid gases in the process of energy creation and combustion in North Korea, the burning of coal is responsible for releasing carbon dioxide into the atmosphere, while coal mining and subsequent processing produce methane gas. The amount of carbon dioxide per capita in North Korea (1989) has been 6.2 tons per year, much more than that of South Korea (5 tons) and that of China or Vietnam, or other countries in Asia (2 tons).⁹

Water Pollution

Most of the North Korean rivers including the Tumen River are seriously polluted. The North Korean media further reports that the Chongchon River's water quality is worsening due to wastewater dumping by the chemical plants upstream. Many ships are discarding oil wastes into the Tumen River, a further indication of North Korean water pollution. If this is the fate of the Tumen and Chongchon Rivers, once known for their clean water, one can imagine the level of pollution in the rivers near big cities such as Pyongyang, Wonsan, Chongjin, and Nampo where industrial areas stand crowded together with old factory facilities.

The Yalu River has been polluted by industrial waste from mines and cement factories, as well as by domestic waste-water from cities in North Korea and China, to the extent that people can no longer drink the water. The Taedong River, a major source of drinking water for Pyongyang residents, contains over BOD(Biological Oxygen Demand) 8 ppm (Parts per million). Dead fish are frequently seen floating on the water and residents who

⁹ Hayes et al., op. cit., p. 7.

drink the tap water unboiled, complain of stomachaches. North Korea has had to provide foreigners with "Sinduck Mineral Water" instead of tap water."¹⁰ In particular, after the construction of West Sea Lock Gate in the estuary of the Taedong River, the industrial wastes from the Nampo region travelled upstream, emitting an offensive odor and causing severe eutrophication. As a result, fish such as the gray mullet can no longer survive.

The trout and dace catches are less than one percent of the amount before the Tumen River became polluted. Tumen River pollution comes from industrial waste flowing out of Musan iron mine, Aoji chemical plant, Kaesantun pulp mill in China, and the Suckhyun paper factory along the lower reaches of the Kaya River in China. It is further exacerbated by the domestic waste water from Hoeryong and Chongsong in North Korea, and Yanji, Longjing, Tumen, and Hunchun in China. The influx of the waste water into the 505 km upstream causing water quality to rank below grade 5, which is below industrial standards.

In contrast with South Korean water pollution, caused by the overuse of agricultural chemicals, fertilizers, synthetic detergents and industrial waste, most North Korean water pollution is caused by industrial waste. Major causes of North Korean water pollution are; release of waste water used for refining minerals or for coal mining; waste water and polluted materials from the iron manufacturing plants and refineries; industrial waste or materials and domestic sewage dumped directly into rivers because of a shortage of sewerage disposal facilities.

Marine Pollution

Serious pollution of major rivers such as the Tumen and Yalu Rivers, is endangering the East Sea as well as the Yellow Sea of South Korea. Among the North Korea seas, the Wonsan Sea is the most seriously polluted. At one time, it was famous for its clear waters, but marine plants began disappearing long ago. What is worse, the phenomenon of red tide occurs yearly from the end of

¹⁰ *Naewoe Press*, January 6, 1992, p. 364.

May until early August, and has caused the near extinction of fish, shellfish and seaweed.

The land reclamation project on the Yellow Sea is the most worrisome in that it will accelerate North Korean marine pollution. As one of the so-called North Korean 'Four Projects for Nature Development,' North Korea enacted 'Movement for Finding New Arable Land' which entails reclaiming 3000,000 jongbo (735,000 acres) of tideland in South Hwanghae Province and South Pyongan Province. That project, comparable to the grand scale reclamation project on the coast of the Yellow Sea in South Korea, raises concerns since it could create a more serious level of marine pollution. The marine ecosystem has most likely been polluted, or even destroyed by waste-water from the Nampo plant and surrounding areas which reversed course after the construction of the West Sea Lock Gate, and soil from the eroded terrace fields on the hillsides has been heaping up at the mouth of the river.

Even though the 1997 deal between Taiwan and North Korea to transport and store Taiwan's low-level nuclear waste in North Korea has been canceled, it is still possible for Pyongyang to seek such a deal again, a worrisome prediction given the acceleration of pollution in the ecological system, especially in the seas nearby. As yet, North Korea is not ready to bury the nuclear waste in its abandoned mines where there is a danger of groundwater seepage. It does not have transport capacity, nuclear processing technology, and storage sites needed, nor has it the engineering technology or facilities to deal with the problem of groundwater. If waste were to be buried in closed mines,¹¹ the seepage of groundwater could create a major safety issue. If nuclear waste were buried in closed mines, and the groundwater flowed into the sea, it would not only pollute the North Korean region but would also accelerate environmental pollution in South Korea. If the contaminated groundwater were to flow into the much smaller Yellow Sea, which also lacks strong ocean currents to disperse the pollutants, the concentrated radioactivity in specific marine areas could trigger serious environ-

¹¹ North Korea concluded an agreement with Taiwan Electric Power Corp. that North Korea would import 60 barrels of Taiwan's low-level nuclear waste and bury it in closed mines in North Hwanghae province over the course of the two years, at a price of \$75 million.

mental problems.

Soil Pollution and Waste Management

North Korean soil has not only been polluted, but rendered sterile due to the widespread destruction of forest, large-scale cultivation of corn, and the use of huge quantities of fertilizers and agricultural chemicals. The large-scale cultivation of corn, rapidly robbed the soil of nutrients, making it infertile. The subsequent use of chemical fertilizers accelerated acidification and infertility of soil, and the indiscriminate use of agricultural chemicals hastened soil pollution. Given North Korea's dearth of arable land as well as the lack of a self-sufficient economy, its desperate agricultural productivity through concentrated land use and an arable land reclamation policy has also been major causes of soil pollution. The quantity of chemical fertilizers used was 1,000 kilogram per hectare (kg/ha) in the 1970s, and its target figure was 2,000 kg/ha in the 1980s. In 1993, the target figure was 2,500 kg/ha, but it has been reported that North Korea actually used over 2,000 kg/ha of chemical fertilizer during the 1990s.¹² In spite of the increased use of fertilizers, North Korean agricultural productivity has not increased; instead, the overuse of fertilizers has only speeded up soil acidification and decreased levels of productivity. The arable land expansion policy, including creation of terrace fields on hillsides, "The Finding New Arable Land" movement, and other land reclamation projects, have also caused serious side-effects. First, there is flooding caused by soil being washed away over agricultural lands, and there is the destruction of forests. In addition, there are various toxic materials produced by mineral mines, coal mines, iron plants, and refineries, as well as soil pollution in regions supporting military facilities.

¹² Since the amount of chemical fertilizer consumption per hectare on the basis of 1988, was 373 kg in South Korea, 415 kg in Japan, 63.3 kg in the Philippines, 38.6 kg in Thailand, and 84.5 kg in the U.S., North Korea has used excessive amounts of chemical fertilizer. Peter Hayes, "Economic Dimensions of Restoring North Korea's Environment," *North Korean Economy in the Transitional Period: The 4th International Academic Conference on the North Korean Economy*, September 17, 1994, under the joint sponsorship of Korea Development Institute and the Korea Economic Daily.

North Korea's inability to deal with the waste, even from the refineries and mines, has led to acceleration of soil and water pollution. In the meantime, North Korea has degraded the Korean peninsula, a land of picturesque rivers and mountains, to that of an international waste dumping-ground by secretly importing a tremendous amount of domestic and industrial wastes from France, Germany, England, and Austria, in return for foreign currencies. In fact, North Korea has imported over 10 thousand tons of waste from other countries on a monthly basis, for the price of \$200 per ton, and it is reported that North Korea plans to import more waste until the year of 2004.¹³

Environmental pollution in North Korea has also led to deterioration of the ecological balance. The condition of the Tumen and Yalu river valleys adjacent to China reveals the full reality of ecological destruction. The thick forests on Mt. Baekdu, and the primeval forest in the border area connecting the Tumen and Yalu Rivers have been ravaged by reckless deforestation and cultivation. The poaching of wild animals and picking of rare plants around Mt. Baekdu has seriously undermined the national flora and fauna in the region. Additionally, since the mountains in Kangwon Province and North Hwanghae Province are low-lying, the North Koreans were able to cultivate arable lands there, creating orchards and hillside terrace fields, while at the same time, stripping the mountainsides in order to get firewood.

The Causes of Environmental Pollution

Among the many reasons for the recent severe environmental pollution, there are specific causes that North Korea must address.¹⁴ Firstly, its environmental policy, which stresses development and food production increases rather than environmental protection or management of the environment; secondly, structural characteristics of socialism with a closed centrally planned

¹³ *Naewoo Press*, "The Reality of the National Land Environmental Protection Policy," no. 1080, October 23, 1997, Weekly-version.

¹⁴ Park Song-dong, "The Situation Regarding the North Korean Environment and the Long-term and Short-term Tasks," *Unified Economy*, Hyundai Research Institute, April 1997, pp. 70-74

economic system which is neither efficient nor environment-oriented since it gives priority to fulfilling production quotas; thirdly, its own self-reliance energy policy, that leads to heavy dependence on coal as an energy resource, and the use of obsolete industrial technology cause a great deal of environmental pollution; fourthly, the lack of investment in environmental sectors owing to the weak economy; fifthly, lack of focus and action on environmental issues by the North Korean authorities and the citizens themselves.

Other examples causing environmental pollution in the process of agricultural development include: "the fortification of every inch of land" since December 1962, the creation of hillside terrace fields in the mid-1970s, "Four Big Businesses for Reshaping Nature" in the 1980s, and overuse of chemical fertilizers and agricultural chemicals in order to increase food production. With the announcement of its "nature reshaping" policy in 1970s, North Korea ordered farmers to cultivate terrace fields on every slope of less than 15 degrees located on mountainsides less than 500 meters above sea level. Within two or three years after the announcement was made, every hill of North Korea was dug up. Consequently, during rainy season, the soil in terrace fields flowed downhill, ruining the paddyfields below, and inundating the rivers with silt, resulting in even more damage.

Since the food ration program was cut in the mid-1980s, many people have burned off the land for cultivation, clearing the woods to create fields to plant corn. Thus, the North Korean government created a situation whereby it could not prevent the people from creating their own garden patches to deal with the food shortage. Such wrong policies recklessly enforced by North Korean authorities have spawned environmental pollution such as soil erosion, and deforestation.

Because of its high dependence rate of over 80% on coal energy, its closed economic system, and obsolete coal-mining facilities, with overuse of low-quality briquets, high concentrations of sulphurous acid gas, monoacidic gas, and nitrogen oxide have led to atmospheric pollution. North Korea had no option but to use the low-quality briquets.

Again, its efforts to import domestic or industrial waste from other countries, and the failed attempt to accept Taiwan's low-level nuclear waste in 1997 is ample proof. What is more, the excessive veneration¹⁵ of Kim Il-sung and his family has interfered with efficient national land management for environmental preservation, and has frustrated efforts to preserve the natural beauty of the Korean peninsula.

In sum, North Korean environmental pollution results from structural inconsistencies, such as pollution-causing heavy industries and a centrally planned economy which places emphasis on the achievement of production quotas, rather than on prevention of natural disasters. Thus, we can conclude that North Korean environmental pollution is an outcome of the implementation of misguided policies such as promotion of an industrial structure which is damaging to the environment, and a lack of investment in environmental protection due to economic difficulties.

Methods of Environmental Cooperation Between South and North Korea

The North Korean environmental issue must be viewed as South Korea's problem as well, in light of its common border as well as the cost burden that must be shouldered after reunification. Thus, it is desirable to find a long-term solution, namely, by inducing environmental cooperation between the South and the North and by fostering a desirable atmosphere for environmental protection on the Korean peninsula. South-North cooperation on environmental preservation and on pollution prevention could promote direct dialogues and government-level exchanges between the South and the North and could lead towards engaging North Korea as a responsible member of the international community. Such engagement in environmental cooperation will

¹⁵ North Korea states that it strictly controls the cutting of trees or even wild plants, and the carving of names on rocks on Mt. Baekdu, the prevention of flood damage and reckless deforestation. Strangely, during a campaign promoting the carving slogans on rocks, North Korea stated that the slogans carved on rocks would be instructive to succeeding generations. As a result, around 4,000 words have been carved in over 60 locations on Mt. Kumgang alone. In one case, the carving is so deep (up to 1-2m) that it can be never restored.

help the two countries to overcome their political and ideological differences, by focusing on the basic universal goals and values: those of improving the quality of life and the health and well-being of all people.

In the short term, economic cooperation with the North should be pursued in parallel with environmental protection measures for the purpose of restoring the North Korean economy and the depleted environment. In the long term, active preparation of prevention measures must be enacted to reduce reunification costs. Once it is damaged, restoring the environment to its original condition is very difficult, costly, and time-consuming. Considering the irreversible nature of environmental degradation, we have to keep in mind that the cost of prevention is preferable to dealing with the aftermath.

The German IFO Economy Institute¹⁶ estimated that a unified Germany would need to invest around 200 billion Deutschemarks (DM) in waste-water and air purification facilities in former East Germany in order to raise the environmental quality of East German districts to that of West Germany, between commencement of German unification and the year 2000. The German federal government has created various investment programs for the reduction of environmental pollution, and has established the environmental infrastructure, including waterworks and sewerage system, water-filtration facilities, and waste-disposal facilities.¹⁷ Since South Korea is far behind West Germany in terms of environmental protection policy measures and financial capability, South Korea will bear a higher financial burden than West Germany. Furthermore, it is feared that the pollution could be more serious, in spite of improvements in the North Korean economy.¹⁸ Thus, environmental cooperation between the two Koreas is essential in

¹⁶ It is estimated that cleaning up the environment in former East Germany will cost 200 billion DM: 125 billion DM for waste water disposal facilities, 23 billion DM for air purification facilities, 34 billion DM for waste disposal units, 11 billion DM for polluted area purification, and 17 billion DM to provide drinking water. In reality the German government has invested only 49.6 million DM in over 63 projects to reduce the environmental damage of former East Germany. The Ministry of National Unification, *Data for the Unified German Situation*, April 1993.

¹⁷ Agency for National Security Planning, *The German Unification Model and the Aftermath of Unification* (Seoul: ANSP, September 1997), p. 312.

view of both reduction of environmental management costs after unification and in terms of prevention.

Short-term Economic Cooperation through International Organizations or Non-Governmental Organizations

While North Korean environmental pollution resulted from inconsistencies in its own system and enforcement of misguided economic policies, we cannot ignore its current economic plight: the food shortage, a lack of energy resources, and a lack of foreign reserves to reshape existing facilities. This situation has made it inevitable for North Korea to pursue environmentally-unfriendly policies. Moreover, it is pointless to expect North Korea to revamp or unconditionally eliminate environmental pollutants without offering any realistic alternatives. It is therefore very important for us to try to find ways to increase environmental cooperation between the two Koreas based on South Korean economic and technological support through international organizations or non-governmental organizations. That is to say, attempts must be made to enlighten North Korea on the importance of the environment through the formation of bilateral or multilateral environmental communities, while at the same time, inducing North Korea to pursue scientific modernization of environmental facilities by helping North Korea's economic recovery.

It is recommended that two Koreas establish a joint research institute as well as a joint environmental research center, thus enabling an in-depth inquiry into the situation of North Korean environmental pollution. South Korea should establish government-level financial and manpower support in parallel, beginning with private or scholarly exchange. It is vital that the two Koreas

¹⁸ It estimated that demands of energy and emissions of atmospheric pollutants for the next 10 years (projected 1.5% growth each year during 1995-2000), using the vector autoregressive (VAR) approach on the basis of the amount of coal, petroleum, and electricity consumption for the last 20 years (1975-97). According to the data, while TSP (Total Suspended Solid), SO₂, CO₂ and NO_x have increased respectively by about 4.55, HC (hydrocarbon) has increased by 16.4%. Kwak Seung-jun and Cho Seung-kuk, "Forecasting Emissions of Atmospheric Pollutants in North Korea: A VAR Approach," *Developing Social Infrastructure in North Korea for Economic Cooperation between the South and the North*, Proceedings of the International Conference, November 9-10, 1998, pp. 365-390.

develop a common perception that the entire Korean peninsula is impacted by the same environmental conditions, and that establishing a set of common goals is essential. For instance, there could be a joint project on the ecological system in the demilitarized zone and on areas of historic interest, a joint study on waste disposal or processing. Exchanges of meteorological observations, and establishment of a natural disaster prevention system are other possible areas of cooperation on the private level, the academic research institute level, and the associate government level.

Another recommendation is the standardization of energy-efficiency measurements and the establishment of a "unification environmental forum" between the two Koreas of a "Northeast Asia Environmental Forum" involving the two Koreas and neighboring countries, and aimed at increasing energy efficiency. In particular, considering that the trans-border characteristics of the environment and serious levels of pollution in China, Mongolia, and Russia, a joint cooperative regime is greatly needed to draw cooperation from neighboring countries. Even though there is no research institute in North Korea with the technological capability to increase energy efficiency or to conduct research into waste recycling, there is the Beijing Energy Conservation Center in China established by Batelle Pacific Northwest laboratory and Lawrence Berkeley National Laboratory of the U.S., as well as a research center which collaborates with Batelle in Russia. As for North Korea, it can expand or reorganize its Center for Rational Use of Energy (CRUE) under the Institute of Thermal Engineering, established by the United Nations Development Programme (UNDP) project.¹⁹

North Korea has continued to exclude South Korea, as it pursues efforts toward building ties with the U.S. and containing the South. Consequently, any efforts at bilateral inter-governmental environmental cooperation could be seen as interference in internal affairs. Thus, for the time being, it is desirable to establish a triangular cooperative regime through international organizations such as the UNDP or the United Nations Environment

¹⁹ Hayes et al., *op. cit.*, p. 25.

Programme (UNEP). At the same time, it is important to make good use of international organizations dealing with environmental protection such as the Northwest Pacific Action Plan (NOW-PAP) with China, Russia, and Japan as members or the "Northeast Asia Environmental Cooperation Conference," a new idea which is being formulated by South Korea, Japan, Russia, and Mongolia. Information and data exchanges should be carried out between the two Koreas, and expand exchanges among environmental organizations in both Koreas, in coordination with non-governmental organizations. Once North Korea begins to participate in the international community, it will be possible to induce it to observe international law and to monitor its efforts toward environmental protection.

Secondly, our support for the improvement of North Korean economic condition should be established as a premise. While North Korea is obsessed with the restoration of its economy, we must prevent it from recklessly developing or exploiting national resources. This can be accomplished through cooperation with North Korea in establishing labor-intensive light industrial complex and productive infrastructure such as energy supply or water resource facilities. In particular, since one of the main causes of environmental destruction is forest damage to expand arable lands, we should make efforts to first, transfer technology dealing with sustainable agriculture, second support a forestation campaign, and finally, help North Korea to develop soil fertilization technology. Tourism development cooperation between the South and the North is considered a desirable measure in view of protecting and preserving the environment in the long-term while giving North Korea an opportunity to improve its economy through earning some foreign currency. Since most North Korean atmospheric pollution is caused by its energy policy and the use of low quality coal, energy cooperation between the two Koreas through joint development of underground resources is also an urgent issue.

Thirdly, scientific and technological modernizations are critical to environmental protection. To this end, South Korea should encourage environmental cooperation by North Korea with eco-

conomic or technological incentives. It is desirable for South Korea to transfer related technology concerning economy of energy and environmental industry and technology to North Korea, and enforce Cooperation with North Korea for industrial development. Environmental cooperation between the South and the North for purification technology and the establishment of capital for environmental infrastructure should be promoted. South Korea should also support the closing or overhaul of the worst pollution-producing factories and industrial facilities, the restoration of the polluted areas through public investment, and the modernization of industrial facilities.

National Land Management Plan for Environmental Preservation

In the mid-term and long-term, South Korea should pursue environmental cooperation at the government level between the South and the North, while maintaining progress in inter-Korean relations. Moreover, South Korea must develop and enforce a joint program to contribute toward the well-being of both Koreas with a master plan that includes a post-reunification economic vision as well as a comprehensive national land-management plan between the South and the North. This must progress in accordance with active economic exchanges and political dialogues between the two Korea. Moreover, South Korea should cooperate for the preservation and improvement of the environment on the Korean peninsula through the signing of the Environment Pact between the South and the North, under a detailed plan at the working-level.

Secondly, we should push ahead with economic cooperation which includes environmental conservation between the South and the North. In this respect, South Korean companies doing business in North Korea must observe guidelines for environmental conservation, training the North Korean employees to develop a pro-environment business mentality. In view of developing balanced industrial structures between the two Koreas, technological and financial measures should be worked out so that North Korea can transform its current pollution-producing heavy industry-based

economy to a system emphasizing a high-technology information service industry producing less pollution.

Thirdly, the nature of the national land development cooperation between two Koreas should be mutually beneficial to both Koreas. For instance, when implementing joint development for commercialization of tourism and underground resources, it would be worth combining the capital and technology of South Korea with the natural resources and manpower of North Korea, not only to prevent environmental destruction and the restore polluted areas in the North Korean region, but also to attract foreign tourists and foreign capital through economic cooperation between the South and the North.

Lastly, we have to keep in mind that environmental cooperation should not be a zero-sum game, but a win-win game from which both parties benefit. **CKP**

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