ANTHROPOSPHERE

Environmental Status and Outlook

In 2019, South Korea had a total population of approximately 52 million residents. The nation ranks 28th in the world for population size, but the size of the country is relatively small, with a population density of 505 people per square kilometer. After Bangladesh (1,067 people/km^2) and Taiwan (646 people/km^2), South Korea has the third-highest population density among countries with over 10 million in population. Furthermore, due to a high ratio of mountains compared to total land area, the nation has had problems and conflicts resulting from pollution issues.

Over the past several decades, South Korea has achieved unprecedented economic growth and urbanization. Such high rates of urbanization have accelerated the deformation and destruction of natural ecosystems, leading to key environmental problems and serious degradation of ecosystems that have recently come to light. As of 2019, Korea's gross domestic product (GDP) per capita is about 31,000 dollars, which places the nation at 27th in the world. GDP per unit area (1 km^2), which shows the size of economic activity relative to the land area, is about 17 million dollars, which is within the top ten nations internationally. In the international community, South Korea is recognized as a country with a very high risk of environmental pollution. The rate of urbanization in South Korea stands at 81.4% (OECD), which is higher than the OECD average of 78.3%.

In the 1960s and 1970s, the environment of South Korea was severely damaged while pursuing rapid economic growth without considering sustainability. However, since the 1980s, as public awareness about the environment has grown, the need for environmental protection has begun to be emphasized. Accordingly, the Korean government set policy goals and established an institutional framework for solving environmental problems. At the same time, the quality of air and water has been continuously improved, as various types of nonprofit environmental organizations actively carry out environmental initiatives. With combined efforts from the government and the organizations, they are also improving ecological integrity and restoring ecosystems.

The government is continuously monitoring the physical environment with respect to the atmosphere, water quality, forests, and other ecosystems. The status of the physical environment has become part of the public agenda as various environmental organizations contribute information and feedback. This has led to an expansion of environmental education programs and a boost in the number of associated organizations. Environmental subjects are currently included in the curriculum from kindergarten to high school. The government supports the activities of private environmental organizations, public-private collaborative initaitives like Environment Day events, and other public interest activities. According to the Ministry of Public Administration and Security in December 2019, 1,083 private environmental organizations are currently participating in a variety of environmental public interest activities promoted by the central and local governments.

In 1992, the UN Conference on Environment and Development was held in Rio de Janeiro, Brazil. There, a global agreement on "sustainable development" was reached. The leaders at the UN Summit adopted the detailed Action Plan (Agenda 21) and the Rio Declaration on Environment and Development. In 1994, in the Ministerial Planning Committee for Earth Environmental Problems, South Korea established a national strategy aimed at sustainable development, keeping pace with this international movement. Korea's national agenda for action was declared. In March 1996, the Agenda 21 plan for national action was drafted and executed, while on June 5, 2000, a comprehensive strategic plan, the "New Millennium Vision for the National Environment," was announced. Soon after, in September 2000, the Presidential Committee for Sustainable Development (PCSD) was created. This committee spearheaded national sustainable development strategies and suggested necessary policy directions.

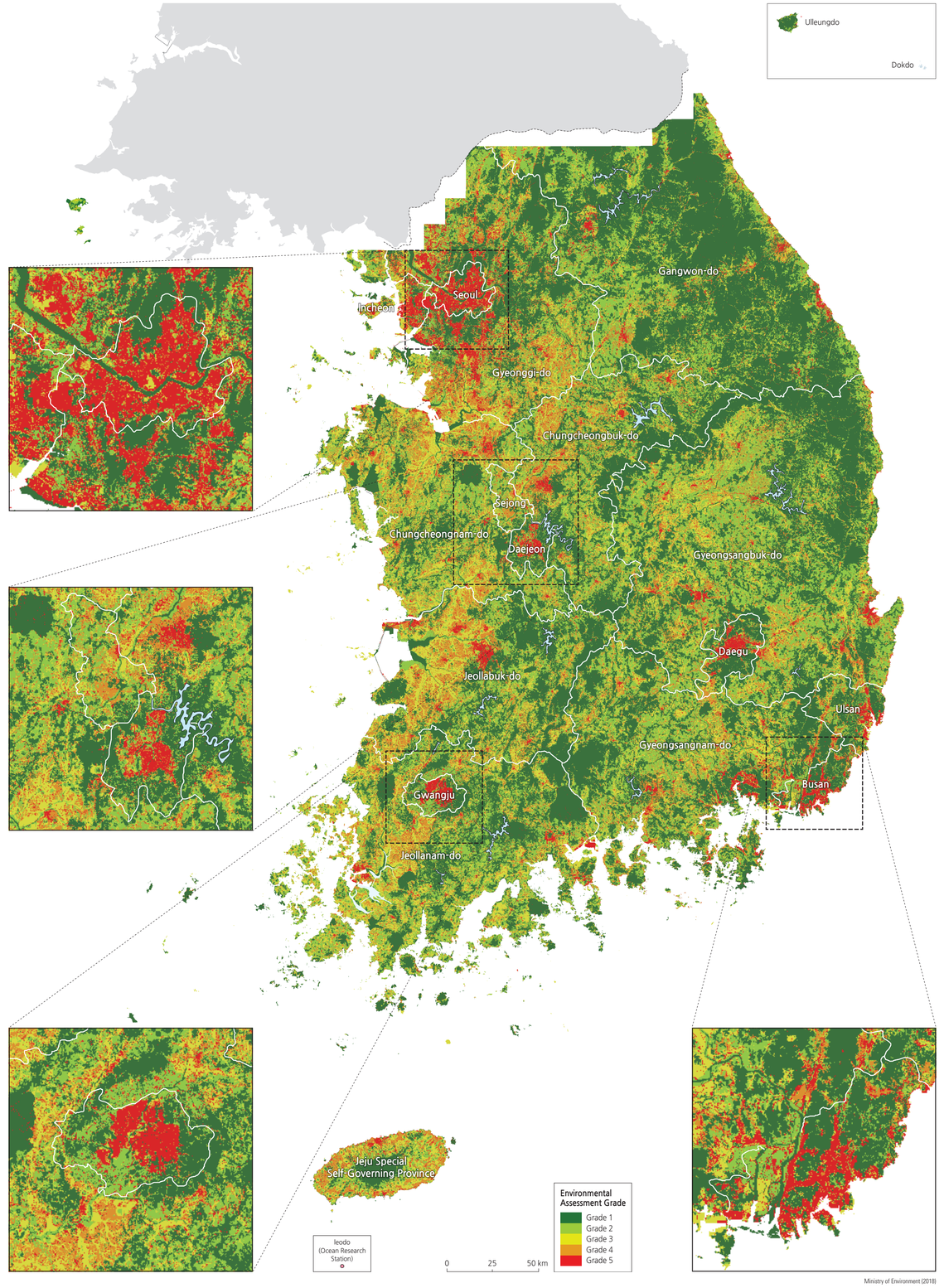
With 5-year intervals from 2006 to 2015, Korea established and implemented the first and second rounds of the "Basic Plan for Sustainable Development." Following changes in domestic and international social, economic, and environmental status, the nation has taken action to meet the main objectives of the Sustainable Development Goals adopted by the 70th UN General Assembly in September 2015. To guarantee the national sustainable development plan and to strengthen global partnerships, South Korea launched the third round of the "Basic Plan for Sustainable Development (2016–2035)" for the next 20 years. Projects associated with that are currently in progress.

National Plans for Sustainable Development

	1st Basic Plan for National Sustainable Development (2006 – 2010)	2nd Basic Plan for National Sustainable Development (2011 – 2030)	3rd Basic Plan for National Sustainable Development (2016 – 2035)
Vision	Balanced Development of Economy, Society, and Environment 21C Model of Developed Countries Co-prosperity of Present and Future Generations	Sustainable Development by 2030 Obtain Global Leading Nation Standards	Harmonious Development of Economy, Society, and Environment
Strategies	· Continuous Management of Natural Resources · Social Integration and Enhancement of National Health · Sustainable Economic Development, Climate Change Response, and Global Environment Conservation (48 Tasks in Total)	· Enhancing the Sustainability of Natural Resources and the Environment · Establishing Climate Change Adaptation and Response Systems · Improving Social Equity and National Health · Enhancing the Sustainability of the Economy and Industry (25 Tasks in Total)	· Establishing a Healthy Land Environment · Establishing a Safe Society · Establishing an Inclusive and Innovative Economy · Developing into a Globally Responsible Nation (46 Tasks in Total)
Goals	· Enhance Economic, Social, and Environmental Policy Integration	· Build National Sustainability up to G20 Standards	· Healthy Land and Environment · Safe and Integrated Society · Inclusive Economic Growth · Globally Responsible Nation

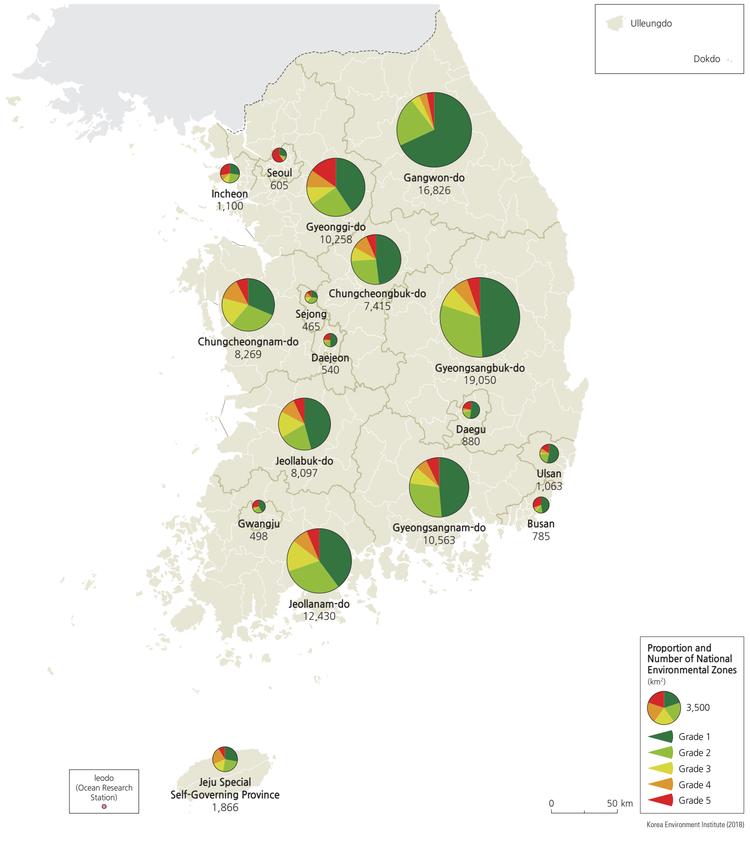
National Land Environment Assessment

National Environmental Zoning Map (2018)



Ministry of Environment (2018)

National Environmental Zones by Province



Korea Environment Institute (2018)

The National Environmental Zoning Map (NEZM) for environmental land use planning classifies land into five grades after comprehensively evaluating various environmental factors. It was created to induce eco-friendly land use and prevent social conflicts that may result from environmental issues or socio-economic losses from inappropriate site selections. In creating and updating the NEZM, thematic maps with 65 evaluation criteria (57 legal criteria and 8 environmental/ecological criteria) are used to analyze the environmental evaluation grade. The highest grade of the resulting analysis is then designated as the grade of a particular area.

The legal criteria items refer to the official conservation zones. This includes water conservation zones, ecological landscape preservation areas, and so forth. The environmental and ecological criteria items correspond to their respective values, such as biodiversity, natural ecology status, and distribution of protected and endangered species. The land is classified into five grades according to preservation value. The first grade represents an area of high conservation value, and the fifth is referring to a region that is undeveloped. The NEZM was first completed in 2005. Since 2005, the accuracy and spatial resolution of the map have been greatly improved through continuous updates.

The NEZM is currently open to the public and being used for prior environmental investigation systems and environmental impact assessments. If facilities causing pollution are built in areas where environmental conservation is important, social conflicts over environmental issues are inevitable. Accordingly, developers can use the NEZM in advance to prevent socio-economic losses due to the conflicts between stakeholders. Social demand for fine-scale maps has increased with growing attention to environmental concerns. Thus, in 2013 1:5,000 scale NEZMs by province were produced. In 2019, the NEZMs for 151 local governments were created.

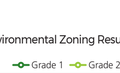
Evaluation of the Preservation Value of the Land

A total of 65 Preservation Items

- Legal Assessment (57)
  i.e. Water Source Protection Area, Ecological Landscape Conservation Area
- Ecological Assessment Value (8)
  i.e. Species Diversity, Rarity, Naturalness

Application of Evaluation Criteria for Agricultural and Urban Areas

Classification into Area for Conservation or for Development



Classify into 5 Grades

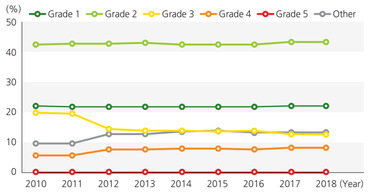
Environmental Zone

High ← → Low

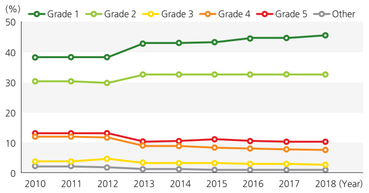
Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade 5

National Environmental Zoning of Gyeongsangbuk-do

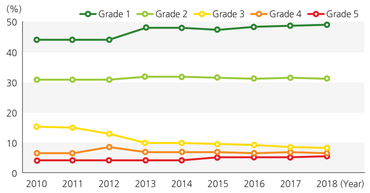
Legal Assessment Results



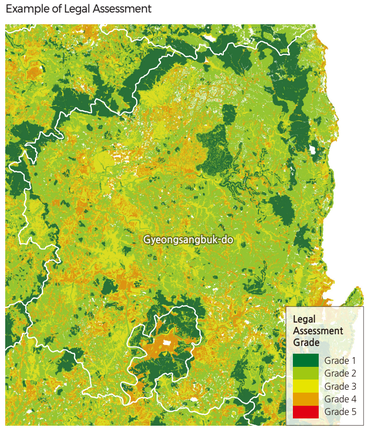
Ecological Assessment Results



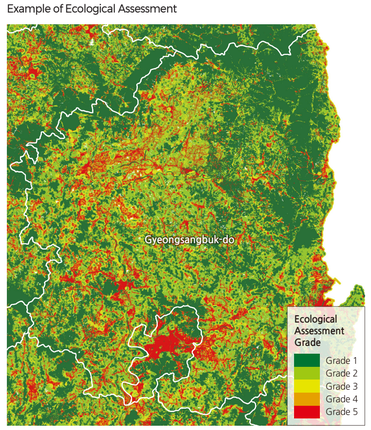
National Environmental Zoning Results



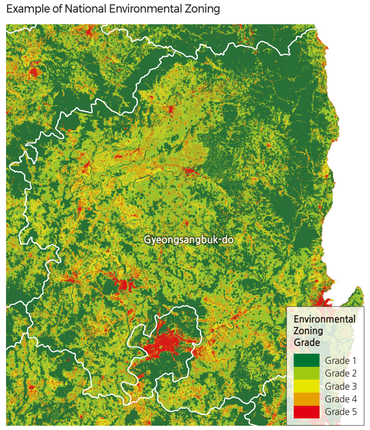
Example of Legal Assessment



Example of Ecological Assessment



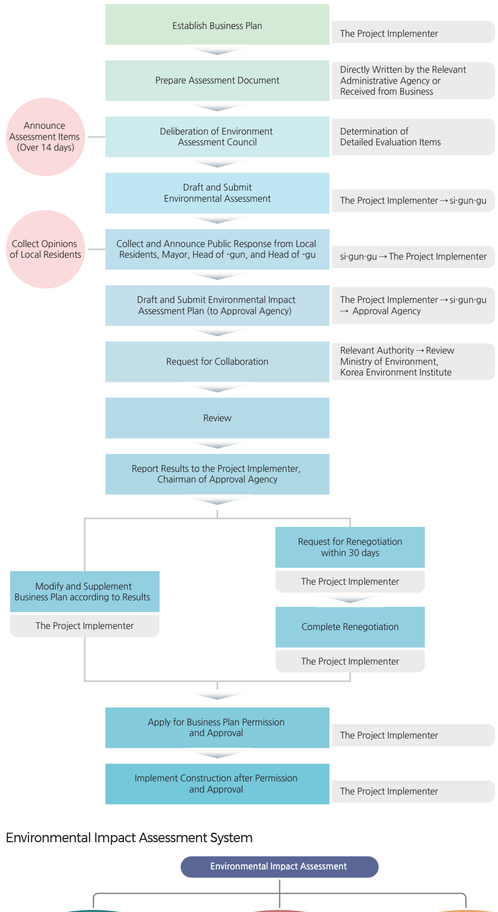
Example of National Environmental Zoning



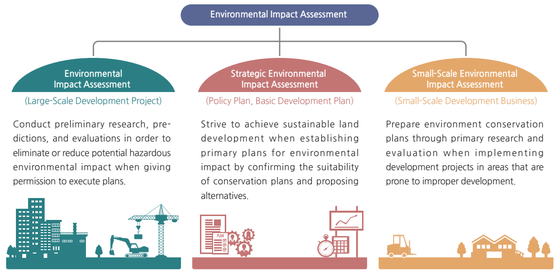
Korea Environment Institute (2018)

General Outline of Environmental Impact Assessment

Procedure of Environmental Impact Assessment



Environmental Impact Assessment System



Ministry of Environment (2019)

Number of Strategic Environmental Impact Assessments

Year	Cases	Head -quarters	Hangang Office	Nakdong -gang Office	Geumgang Office	Yeongsan -gang Office	Wonju Office	Daegu Office	Jeollabuk -do Office
2012	357	35	85	59	45	36	24	54	19
2013	826	73	143	150	112	114	67	103	64
2014	811	74	163	124	119	112	66	100	53
2015	926	59	189	138	124	127	113	104	72
2016	175	6	37	33	27	16	22	25	9
2017	653	82	120	100	94	79	53	76	49
2018	486	74	80	42	71	63	54	56	46
2019	456	71	85	60	57	55	58	43	26
Total	4,690	474	902	706	649	602	457	561	338

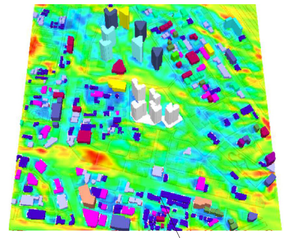
EIASS (2019)

The Environmental Impact Assessment (EIA) comprehensively predicts, analyzes, and evaluates environmental impacts of various policies and development projects. The EIA aims to create and maintain a pleasant environment by guiding environmentally sound and sustainable development.

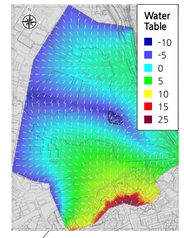
The Korean government operates the assessment procedures, targeting initiatives such as large-scale development projects or specific programs to minimize the destruction of nature and environmental pollution. As a means of proactive protection, the EIA is designed to consider economic and technical aspects and environmental factors when establishing or conducting a development project. According to the Environmental Impact Assessment Act, the Korean government carries out the following three environmental impact assessments: "Strategic Environmental Impact Assessment," "Environmental Impact Assessment," and "Small-scale Environmental Impact Assessment."

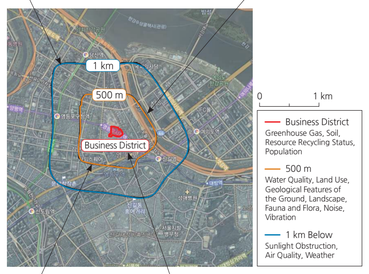
Example of Environmental Impact Assessment (Urban Redevelopment at Yeongdeungpo 1-13)

Weather Condition Survey

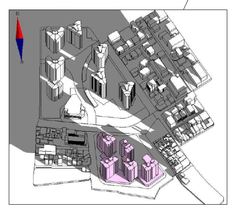


Groundwater

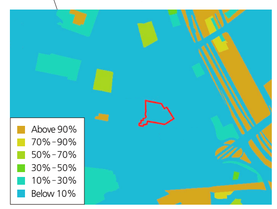




Solar Energy Modeling



Soil (Status of Impermeable Soil Pavement)



Seoul-si (2019)

Number of Environmental Impact Assessments

Year	Cases	Head -quarters	Hangang Office	Nakdong -gang Office	Geumgang Office	Yeongsan -gang Office	Wonju Office	Daegu Office	Jeollabuk -do Office
1982 - 2008	3,951	977	718	497	418	421	332	390	198
2009	305	55	67	49	37	32	32	20	13
2010	288	32	56	55	39	24	31	43	8
2011	189	32	36	20	30	23	15	17	16
2012	219	33	36	51	27	21	15	23	13
2013	157	39	23	25	19	15	11	19	6
2014	179	46	21	35	27	11	18	12	9
2015	168	34	23	26	25	18	17	19	6
2016	40	7	10	6	3	5	2	5	2
2017	142	32	23	21	27	7	12	12	8
2018	143	28	36	24	12	13	13	10	7
2019	135	26	20	24	19	15	14	13	4
Total	5,916	1,341	1,069	833	683	605	512	583	290

EIASS (2019)

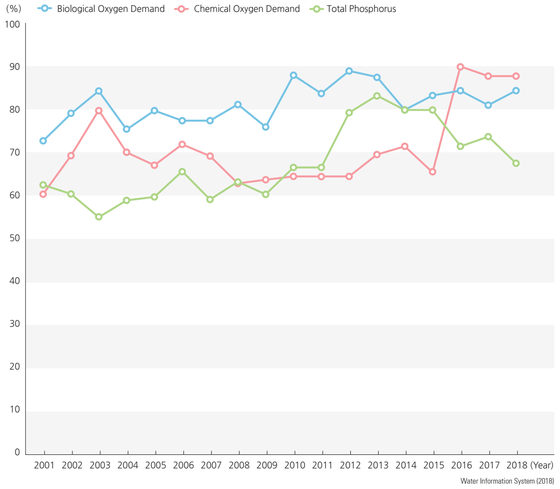
Number of Small-Scale Environmental Impact Assessments

Year	Cases	Head -quarters	Hangang Office	Nakdong -gang Office	Geumgang Office	Yeongsan -gang Office	Wonju Office	Daegu Office	Jeollabuk -do Office
2012	1,096	21	335	101	174	117	134	111	103
2013	1,924	53	331	201	331	258	287	252	211
2014	1,941	32	306	181	375	344	244	255	204
2015	1,962	15	387	184	371	329	281	249	146
2016	2,334	11	502	174	442	358	328	322	197
2017	3,436	10	646	277	570	710	436	375	412
2018	5,758	15	810	363	841	1,557	602	658	912
2019	3,690	13	702	243	542	815	498	493	384
Total	22,141	170	4,019	1,724	3,646	4,488	2,810	2,715	2,569

EIASS (2019)

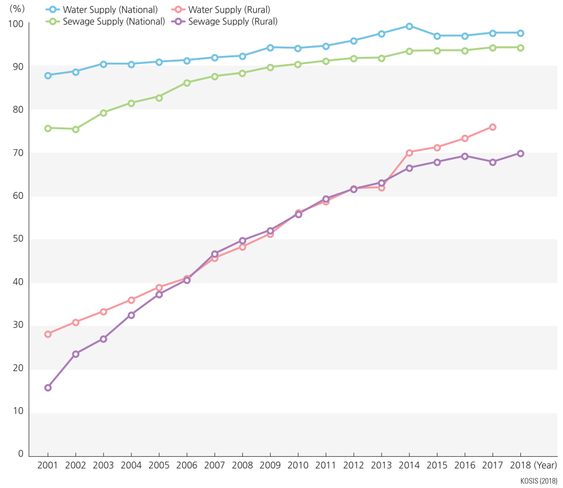
Improvement of Environmental Indicators

Water Quality by Year



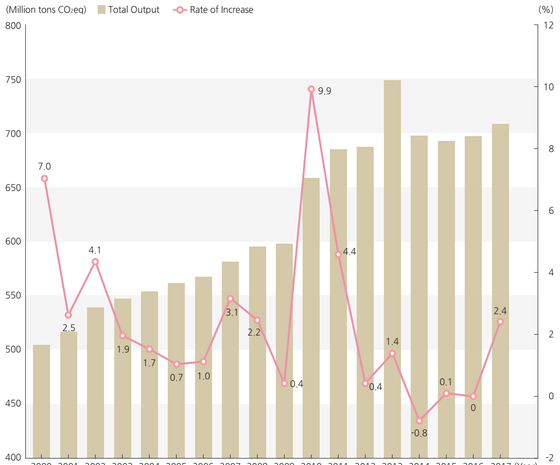
Water Information System (2018)

Supply Rates of Water and Sewage by Year



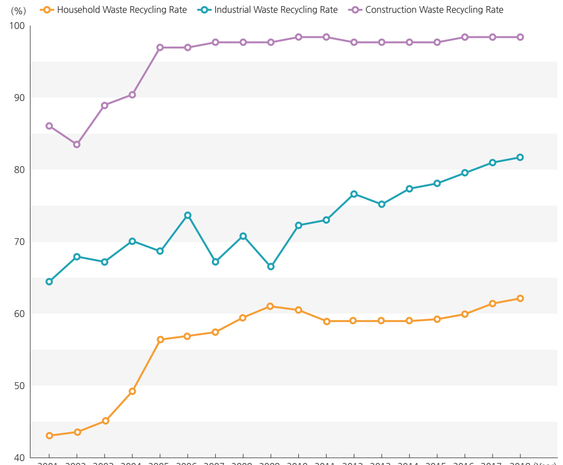
KOSIS (2018)

Greenhouse Gas Emissions by Year



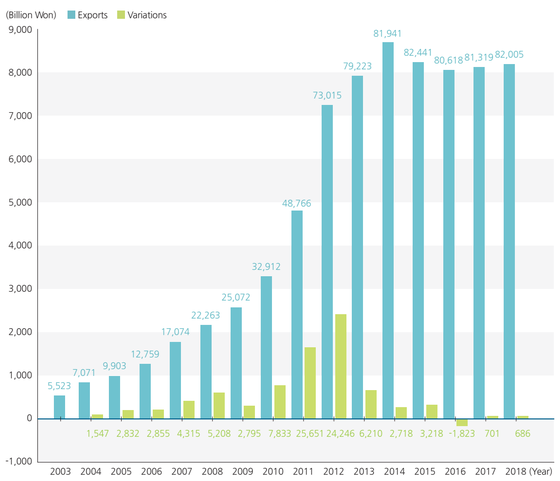
Greenhouse Gas Inventory & Research Center (2019)

Municipal Waste Recycling Ratio by Year



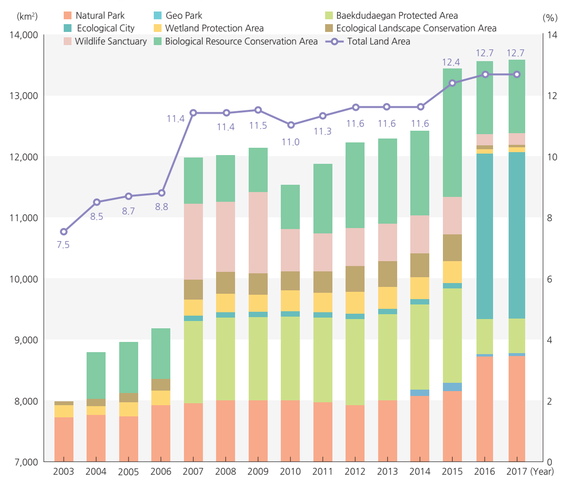
Ministry of Environment (2018)

Status of Exports in Environmental Industries by Year



KOSIS (2018)

Expansion in Ecological Spaces by Year



Ministry of Environment (2018)

Promotion of Eco Friendly Lifestyle and Environmental Industries

Number of Households Joining the Carbon Points System

2007: 500,000 → 2018: 2,870,000

Green Products Purchase Amount (100 Million Won)

2008: 15,840 → 2018: 33,073

Investment in Environmental Pollution Prevention (100 Million Won)

2008: 29,141 → 2018: 35,010

National Greenhouse Gas Emissions (Million Tons)

2007: 580.7 → 2017: 709.1

Everyday Environmental Improvements

Number of Air Pollutant Emissions Companies

2007: 42,774 → 2018: 56,584

Number of Noise Vibration Emissions Facilities

2008: 38,156 → 2018: 41,476

Amount of Soil Pollution

2008: 4,042 mg/kg → 2018: 21,258 mg/kg

Number of Deaths in Safety Accidents per 100,000 Children

2008: 6 → 2017: 2.4

Improvement in National Land Environmental Value

Native Species Status

2009: 33,253 → 2019: 52,628

Number of Species with Endangered Wildlife Designation

2008: 221 → 2018: 267

Ecological Landscape Conservation Sites

2007: 32 → 2017: 33

Total Area with Marine Protected Designation

2009: 257.244 km² → 2019: 1780.352 km²

Ministry of Environment (2019)

Many environmental indicators in South Korea are steadily improving due to the efforts of the citizens and the government. The government strengthens the environmental management system to create an ecologically healthy and safe environment by preventing urban sprawl, inspecting hazardous chemical handling facilities, and managing environmental diseases. In 2014, while the government simplified the licensing processes, the Integrated Approach to Environmental Management was established to effectively suppress pollutant emissions. The project was increasing the rate of achieving "good water" based on water pollution indicators. Accordingly, the indicators were beneficial for improving the water quality of rivers and lakes nationwide. Also, water supply distribution systems have been enhanced, supplying clean water to farming and fishing villages. The supply rate of the sewer system is also increasing, while the concentration of water pollutants is continuously decreasing.

Global concerns regarding climate change have led to proactive efforts on the local level to reduce greenhouse gas (GHG) emissions. Maintaining pace with the international society, Korea aimed to reduce 30% of GHG emissions by 2020 while instituting a low-carbon socio-economic structure. The government also maximizes resource circulation by recycling wastes and cultivates the environmental industry as the nation's new growth engine. The export volume for Korea's environmental industry has increased from 0.7 trillion KRW in 2004 to 8.2 trillion KRW in 2018. It is expected to be of great help in creating new jobs and increasing revenue.

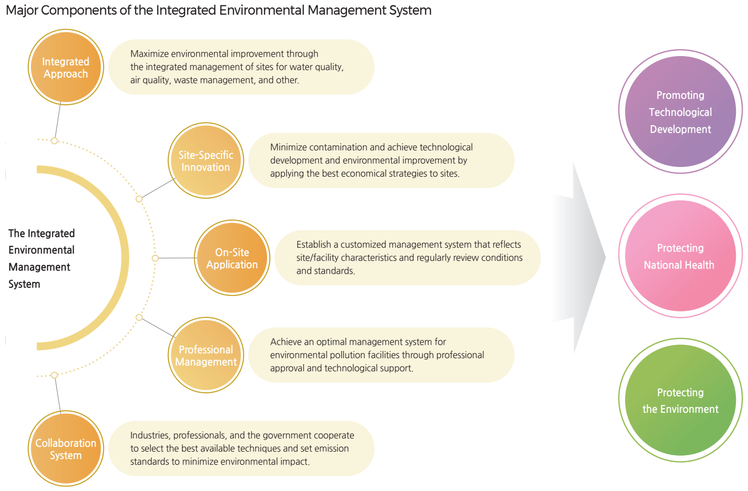
There are tangible outcomes from promoting the expansion of ecological space, advancement in biodiversity management, restoration of stream ecosystems, and reduction of ultra-particulate matter. For example, parks and protected areas are steadily expanding as more natural parks are designated and managed as places of relaxation and ecological exploration.

It is possible to know whether environmental indicators are improving by reviewing eco-friendly living, environmental industries, living environments, and national environmental values. The data on the number of households who have subscribed to the carbon points system, the purchase amount of green products, and the investment cost to prevent environmental pollution indicate that the scale of eco-friendly living and environmental industries is increasing. However, with urbanization, the number of businesses that discharge air pollutants, the number of facilities that discharge noise and vibration, and the level of soil pollution are constantly rising. Therefore, an active response is necessary to improve the living environment.

Lastly, the increasing number of ecological and landscape conservation areas, marine protected areas, native species, and endangered wildlife suggests that the nation's views of the natural environment are gradually changing.

Over the past 40 years, South Korea has managed water pollutants, air pollutants, and wastes separately. Individual management did not reflect characteristics and conditions of each industrial sites, so the effect of improvement by sector did not lead to overall environmental improvement. The government has introduced the "Act on Integrated Management of Environmental Pollution Facilities," which assists big industries that cause a large environmental impact to manage pollutants in an integrated manner. With the implementation of the Act, the nation pursues comprehensive and effective environmental management, which mitigates the burden of obtaining multiple environmental licensing for industries. This leads to a parallel improvement of environmentally sound technology, restoration in environmental quality, and the cultivation of industries and their competitive edge.

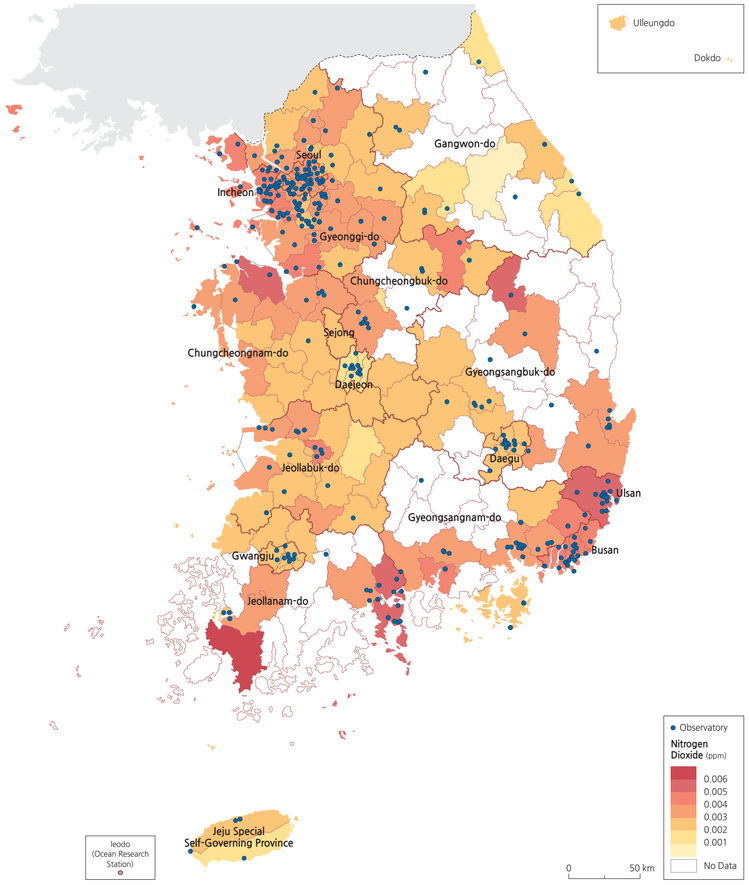
Major Components of the Integrated Environmental Management System



Ministry of Environment (2019)

Air Pollution Monitoring

Air Pollution Measurement Network



Air Korea (2018)

Fog and Fine Dust

Air Pollution Monitoring Station

Fine Dust Measuring Instrument and Traffic Light

South Korea has conducted various environmental projects monitoring factors responsible for environmental pollution. The data obtained through these projects provide the public real-time information and are used as the basis for national and local environmental policies.

As of 2018, the national air pollution monitoring network (584 stations) was implemented to investigate the patterns of ambient air pollution and to determine whether air quality standards were being achieved. The review and evaluation committee determines the degree of risk by referring to toxicity, ecosystem impact, and emissions. This network is composed of an urban air monitoring network (333 stations), a roadside air monitoring network (40 stations), a national background monitoring network (3 stations), a suburban air monitoring network (22 stations), an acid deposition monitoring network (41 stations), an atmospheric heavy metal monitoring network (56 stations), a hazardous air pollutants monitoring network (34 stations), a photochemical air pollutant monitoring network (18 stations), a global atmosphere monitoring network (1 station), a $PM_{2.5}$ monitoring network (30 stations), and an intensive monitoring network (6 stations).

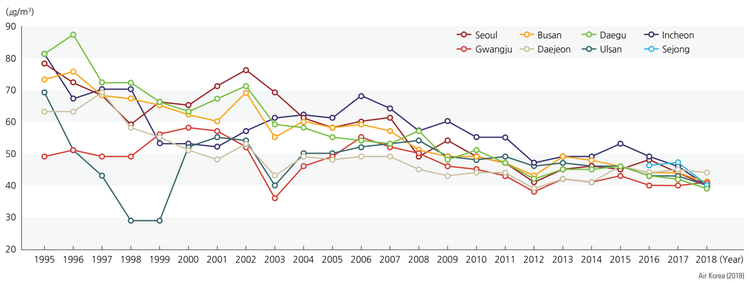
Air Pollution Monitoring

Types of Monitoring Networks	Released Target Items	Purposes	Number of Observatories
Urban Air MN	SO_2, CO, O_3, NO_2, PM_{10}, $PM_{2.5}$, other	Identify Achievement of Environmental Standards by Detecting Average Urban Air Quality	450 (165 Cities and Guns)
Roadside Air MN	SO_2, CO, O_3, NO_2, PM_{10}, $PM_{2.5}$, Pb, HC, Traffic, other	Detect Air Quality of Roadsides with Large Floating Population	47 (22 Cities and Guns)
National Background MN	SO_2, CO, O_3, NO_2, PM_{10}, $PM_{2.5}$, other	Identify National Background Air Quality and Detect Overseas Inflow or Outflow of Pollutants	3 (3 Cities and Guns)
Suburban Air MN	SO_2, CO, O_3, NO_2, PM_{10}, $PM_{2.5}$, other	Identify Background Air Quality of Suburban Areas of Cities	22 (21 Cities and Guns)

Air Korea (2018)

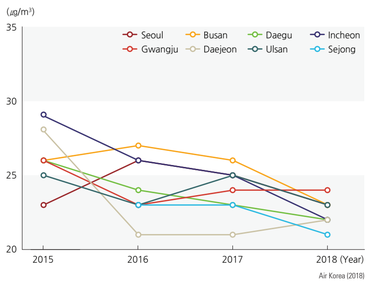
The data measured at the stations are stored at the National Air Pollution Information Management System (NAMIS). Data on air pollution is publicized in real-time through "Air Korea" (www.airkorea.or.kr), launched in December 2005.

Change in Fine Dust



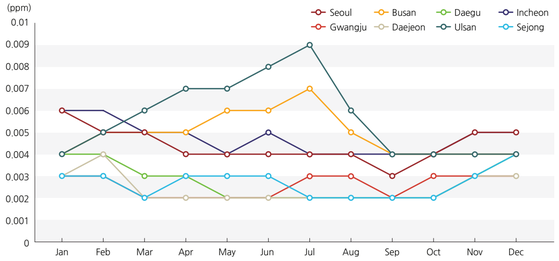
Air Korea (2018)

Change in Ultra Fine Dust



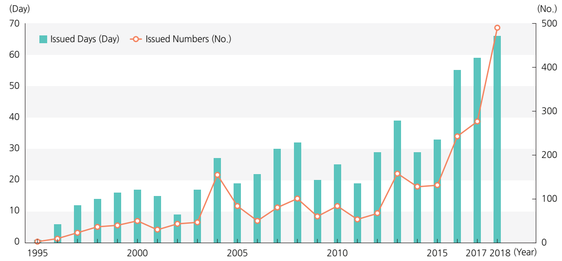
Air Korea (2018)

Monthly Sulfur Dioxide Air Pollution Level (2018)



Air Korea (2018)

National Ozone Warning by Year



Air Korea (2018)

Air pollution information is disclosed spatially in each measurement station and administrative district and temporally in daily, monthly, and yearly units. The information includes values of sulfurous acid gas (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), fine dust (PM_{10} $PM_{2.5}$), lead (Pb), and benzene. These substances are mainly generated from industrial and fuel combustion processes. Sulfur dioxide, carbon monoxide, and fine dust (PM_{10}, $PM_{2.5}$) are gradually decreasing since the first measurement, and nitrogen dioxide is showing a slight decrease while repeating increases and decreases. On the other hand, ozone is a steadily increasing trend, excluding the year 2018, during which it decreased slightly.

To reduce the damage caused by a high concentration of air pollution, the Ministry of Environment launched a PM_{10} forecasting program for metropolitan areas (Seoul, Incheon, Gyeonggi-do) in August 2013 and expanded it throughout the country. In 2014, the forecasts were extended to include $PM_{2.5}$ and ozone. As of 2020, a total of 19 regions are operating forecasting systems. The forecast level is classified into four stages based on the daily average, and it takes into account the atmospheric environmental standards and the impact on health.

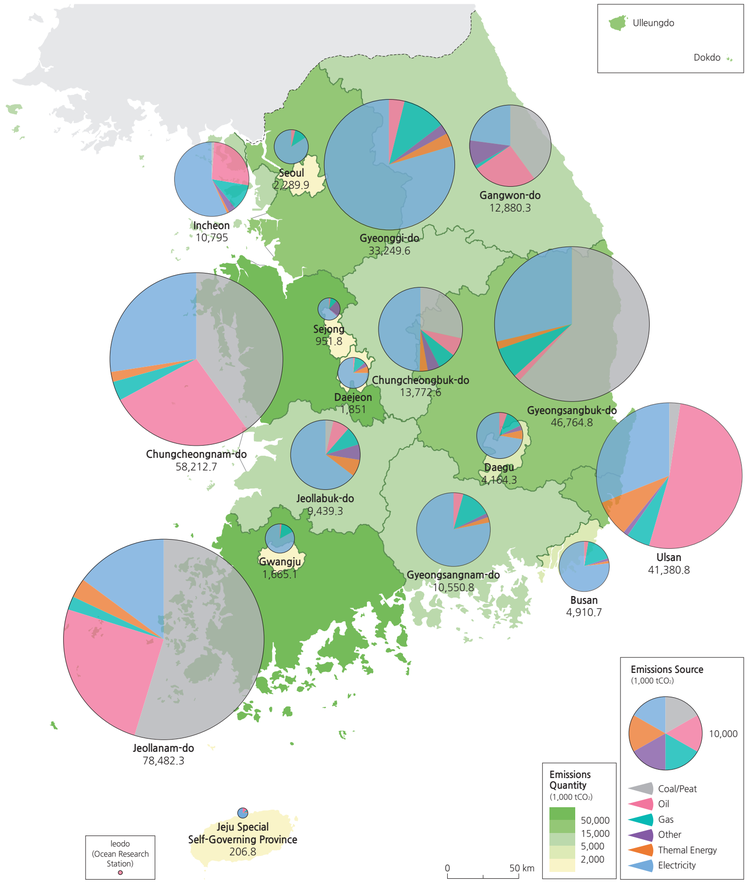
Ozone Warning System

Classification	Warning Criteria	Effect on Human Body
Caution	Ozone Concentration exceeding 0.12 ppm/hr	Irritation in Eyes and Nose, Anxiety, Headaches, Increased Breaths
Warning	Ozone Concentration exceeding 0.3 ppm/hr	Stimulation in Respiratory System, Chest Compression, Failing Eye Sight
Serious Warning	Ozone Concentration exceeding 0.5 ppm/hr	Pulmonary Function Insufficiency, Stimulation in Respiratory System, Septicemia

Air Gangwon (2018)

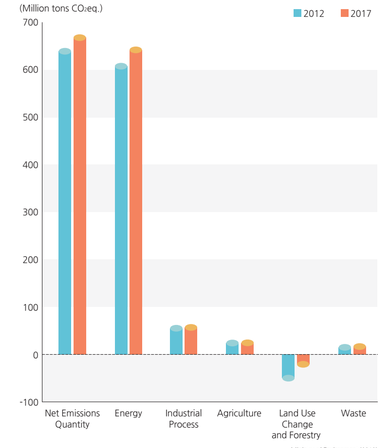
The Korean government has implemented an air pollution warning system for ozone levels. People can know the degree of pollution through the warning system when high concentrations of ozone or yellow dust occur. It notifies respiratory disease patients, the elderly, and children that are prone to harmful levels of ozone concentration and also strives to encourage the voluntary cooperation of citizens. First initiated in 1995 in Seoul, all local governments now utilize the warming system to verify ozone concentrations and issue warnings accordingly.

Greenhouse Gas Emissions by Province



National Greenhouse Gas Inventory Report (2018)

National Greenhouse Gas Emissions by Year

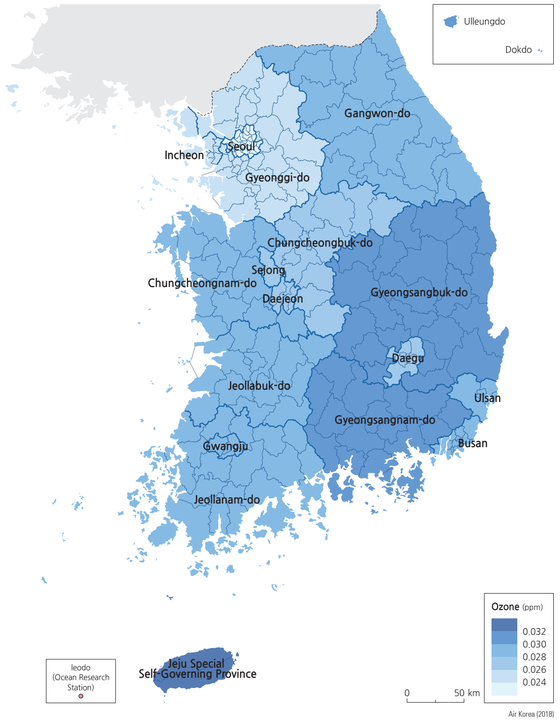


Ministry of Environment (2019)

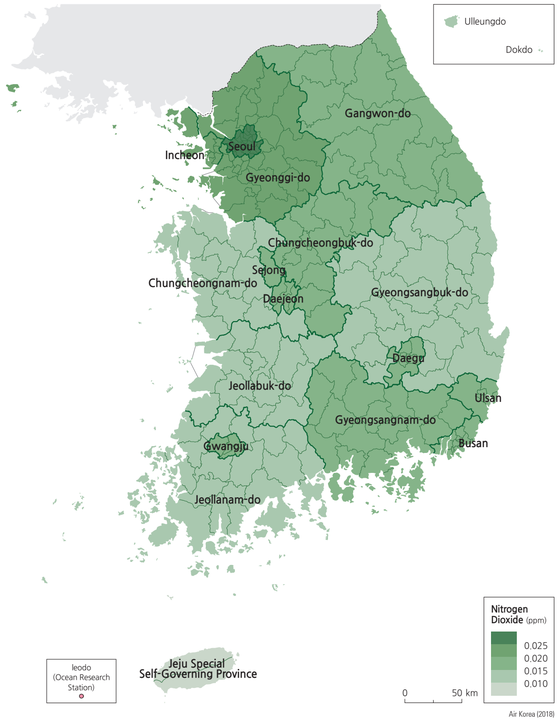
Currently, Korea's GHG emissions are estimated according to the 1996 guideline proposed by the Intergovernmental Panel on Climate Change (IPCC). The government established the Greenhouse Gas Inventory and Research Center of Korea (GIR), which conducts monitoring and research on GHG emissions and reduction strategies. In 2017, total GHG emissions in South Korea were recorded at 710 million tons of carbon dioxide (CO_2) equivalent. This represents an increase of 140% compared with 292.3 million tons of CO_2 equivalent in 1990 and 3% compared with the total emissions of 690 million tons of CO_2 equivalent in 2012. In 2017, the energy sector accounted for the largest portion (87% of total GHG emissions), followed by the industrial processes sector (8%), the agricultural sector (3.0%), and the waste sector (2%).

In 2008, South Korea declared a "low-carbon, green growth" strategy as a new vision to guide the nation's long-term development (60 years), and in 2009 announced the GHG reduction target as the mid-term plan. In 2020, 80 local governments formed the "Carbon Neutral Local Government Action Solidarity" and decided to practice carbon neutrality.

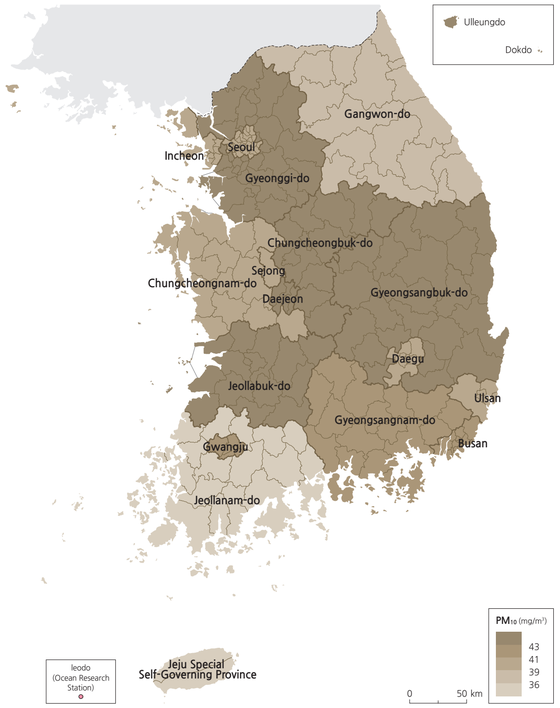
Ozone Concentration by Province



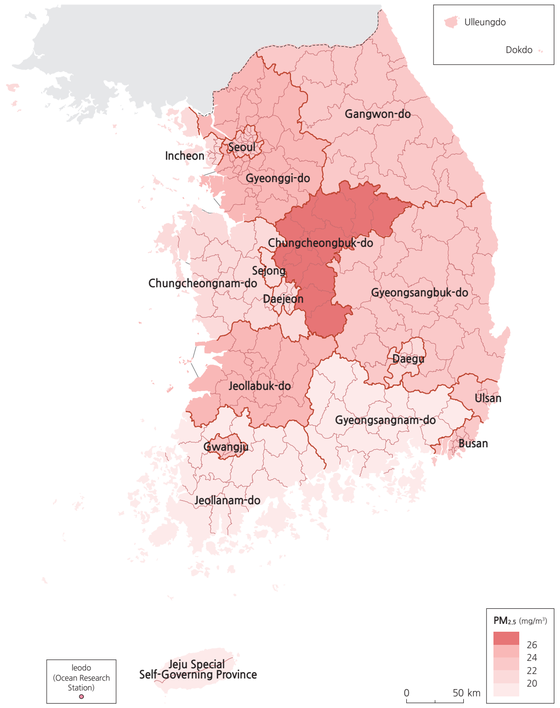
Nitrogen Dioxide Concentration by Province



Particulate Matter (PM_{10}) Concentration by Province

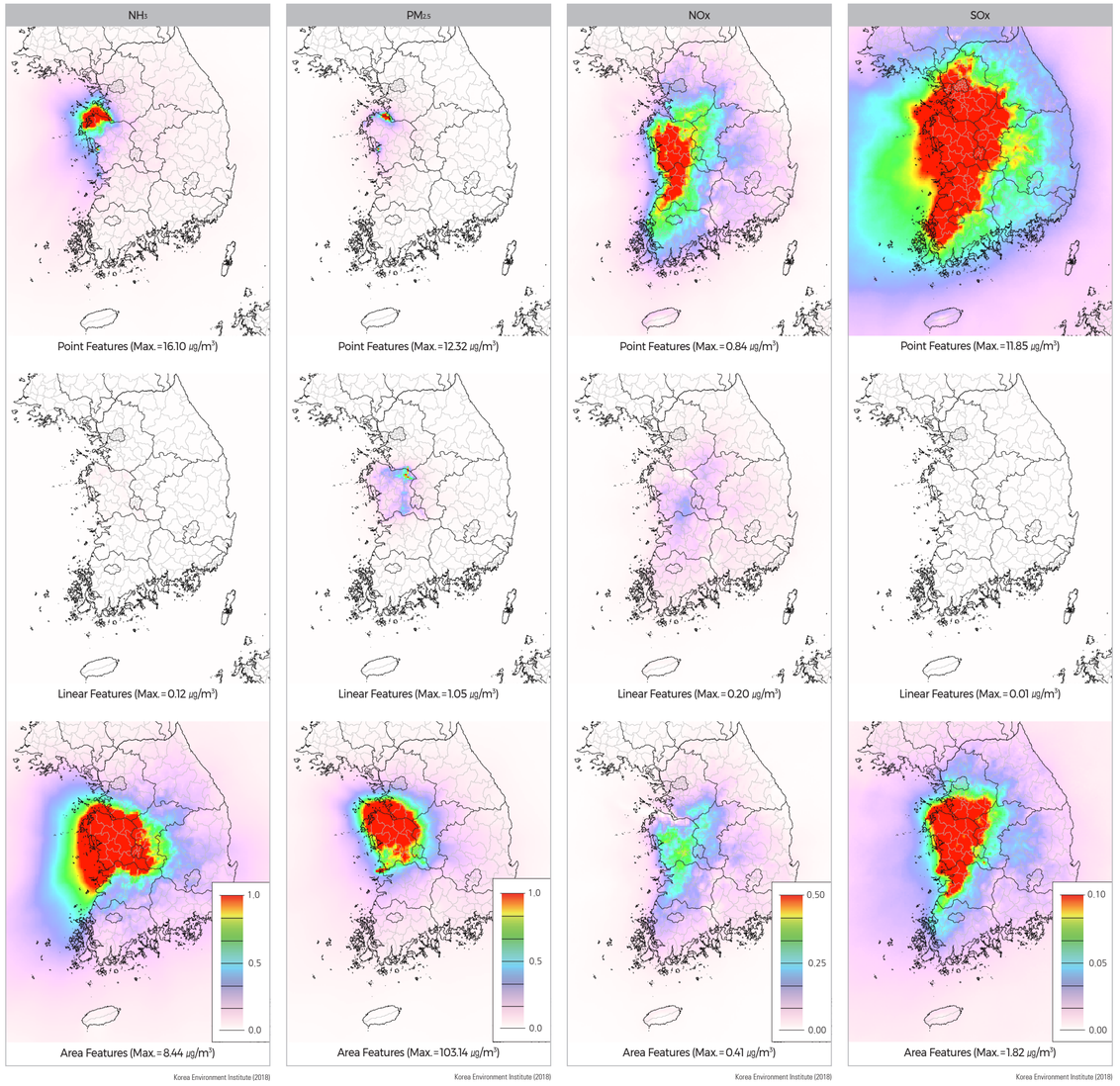


Ultrafine Particle ($PM_{2.5}$) Concentration by Province



Ultrafine Dust Modeling

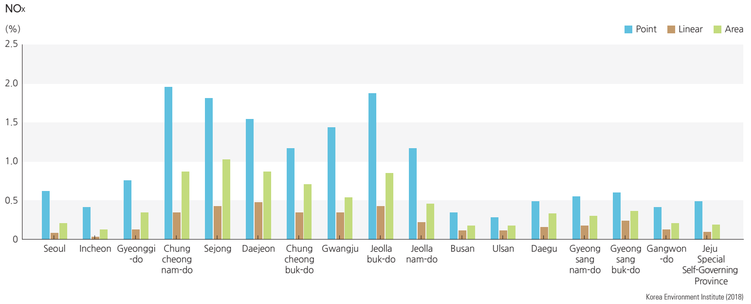
Distribution of Ultrafine Dust ($PM_{2.5}$) in Korea Originated from Air Pollutants in Chungcheongnam-do



Chungcheongnam-do is an area where large-scale petrochemical industrial parks are concentrated. Air pollution in this area is serious because the area is responsible for 50% of the total power generation of the nation's coal-fired power. Since 2015, Chungcheongnam-do has been named as the local government that has emitted the most air pollutants each year. Hyundai Steel, located in Dangjin-si of Chungcheongnam-do, is the business site with the highest emissions of pollutants in the country. Therefore, Chungcheongnam-do introduced the results of predictive modeling of air quality. These results estimated the effect of air pollutants in Chungcheongnam-do on the distribution of ultrafine dust in Korea. This predictive model used pollutant emissions data in 2015 obtained from the National Institute of Environmental Research (NIER).

The maps resulting from the modeling show how ultrafine dust ($PM_{2.5}$) originating from NO_2, SO_2, VOC, NH_3, and $PM_{2.5}$ in Chungcheongnam-do spreads across the country. Air pollutants generated in Chungcheongnam-do have a profound effect on the whole of South Korea, particularly the western regions. For example, the concentration of ultrafine dust generated by NOx is not much different between Chungcheongnam-do, which is the original emission site of NOx, and Jeollabuk-do, adjacent to the south. In other words, there is no significant difference in the concentration of ultrafine dust between the two areas. This means that air pollutants can have a great impact on the atmosphere not only of the local government but also the neighboring municipalities.

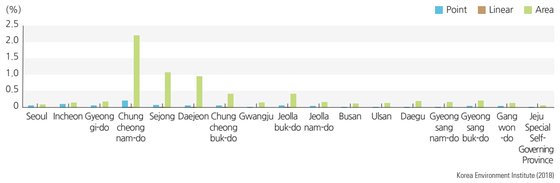
Contribution Rate of Air Pollutants in Chungcheongnam-do for Ultrafine Dust by Province



Korea Environment Institute (2018)

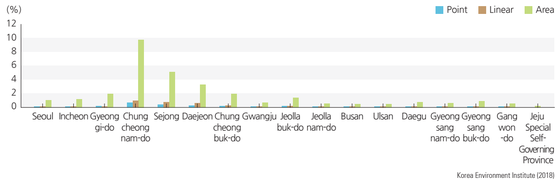
Contribution Rate of Air Pollutants in Chungcheongnam-do for Ultrafine Dust by Province

NH_3



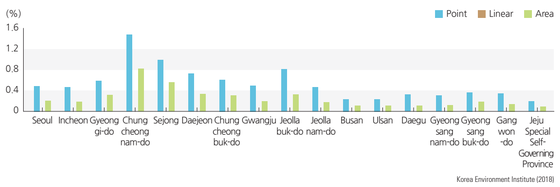
Korea Environment Institute (2018)

$PM_{2.5}$



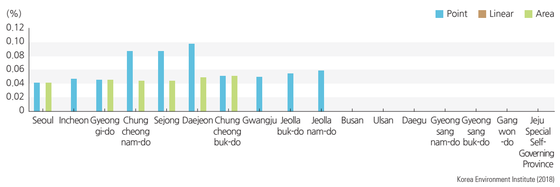
Korea Environment Institute (2018)

SO_x



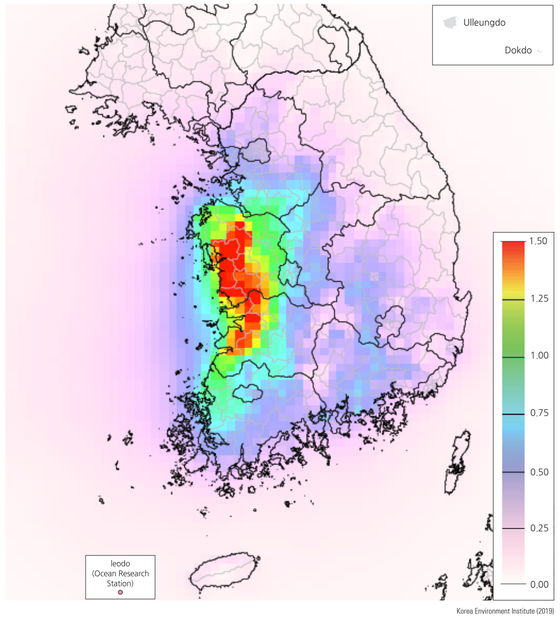
Korea Environment Institute (2018)

VOC



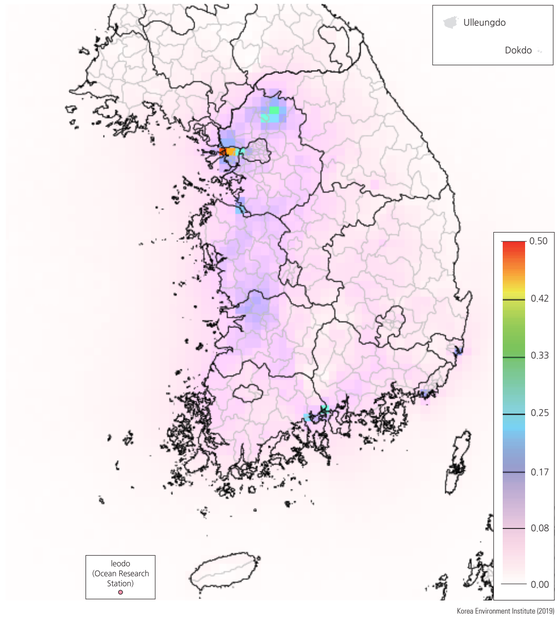
Korea Environment Institute (2018)

National Distribution of Ultrafine Dust Influenced by Coal-Fired Power Plant



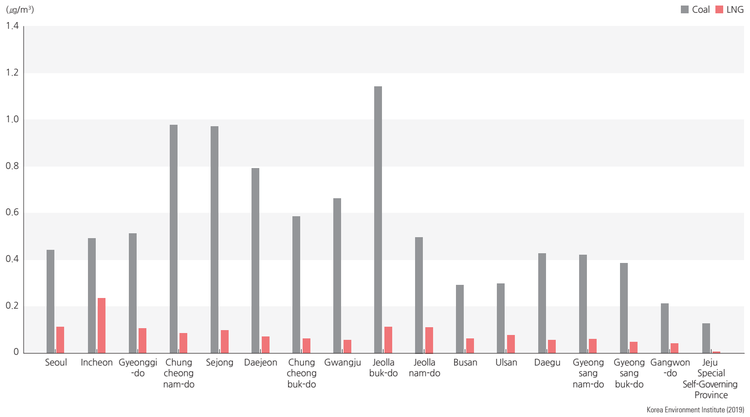
Korea Environment Institute (2019)

National Distribution of Ultrafine Dust Influenced by LNG-Fired Power Plant



Korea Environment Institute (2019)

Concentration of Ultrafine Dust by Province Originated by Coal-fired and LNG-Fired Power Plants



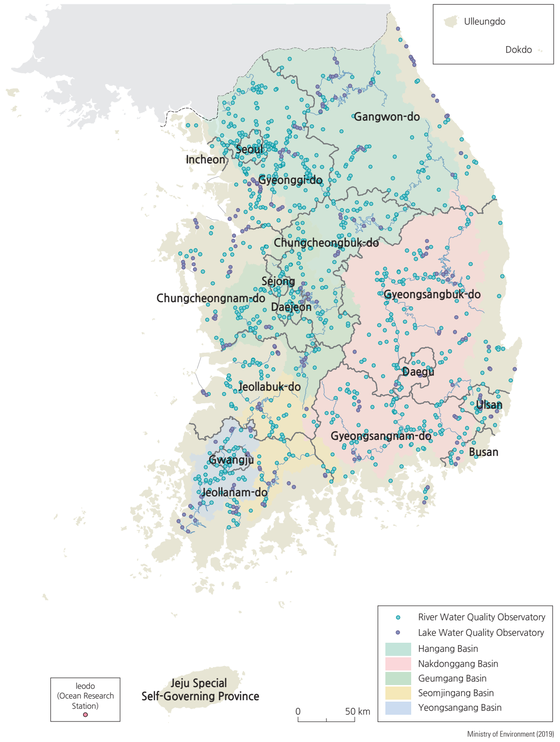
Korea Environment Institute (2019)

The results of air quality modeling also provide meaningful information about the effect of domestic coal-fired power plants and LNG-fired power plants on the distribution of ultrafine dust. The concentration of ultrafine dust at coal-fired and LNG-fired power plants is 0.51 μg/m^3 and 0.10 μg/m^3, respectively. The concentration at the coal power plant was five times higher than the values measured at the LNG-fired power plant.

Looking at the concentration, by province, of ultrafine dust generated by the coal-fired power plants, Jeollabuk-do is 1.14 μg/m^3, which is the largest concentration among all local governments. Chungcheongnam-do is 0.98 μg/m^3 and Sejong is 0.97 μg/m^3. In the case of the LNG-fired power plant, Incheon is 0.24 μg/m^3, Seoul is 12 μg/m^3, and Jeollanam-do is 12 μg/m^3. The regions affected by coal-fired power plants are mainly Chungcheongnam-do and Jeollabuk-do. The regions affected by LNG-fired power plants are mainly the metropolitan areas, but it varies by region. The annual average of ultrafine dust may be slightly different. It depends on which year's data are used. This is because emissions and weather conditions are different from year to year.

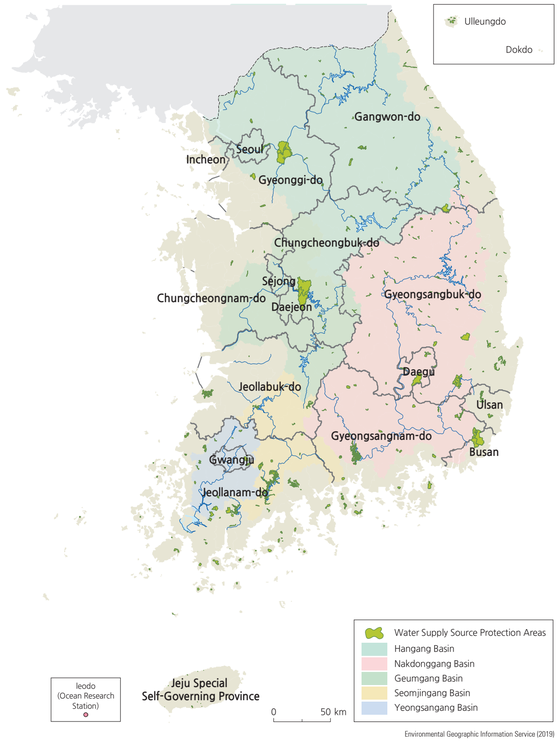
Water Pollution Monitoring

Distribution of Water Quality Observatories



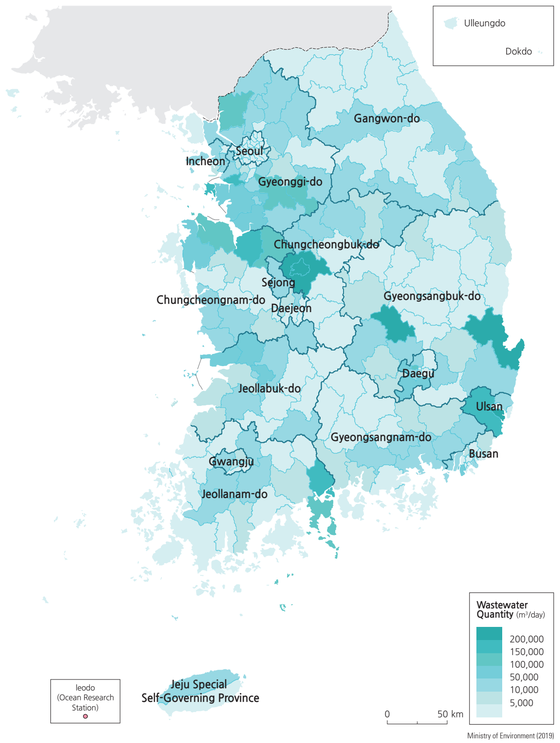
Ministry of Environment (2019)

Water Supply Source Protection Area



Environmental Geographic Information Service (2019)

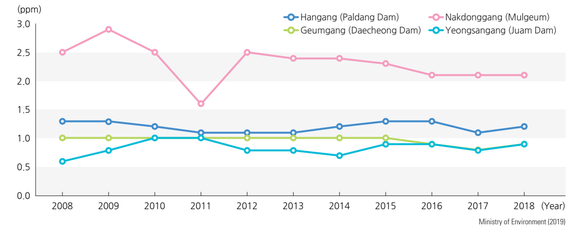
Wastewater Pollution by Province



Ministry of Environment (2019)

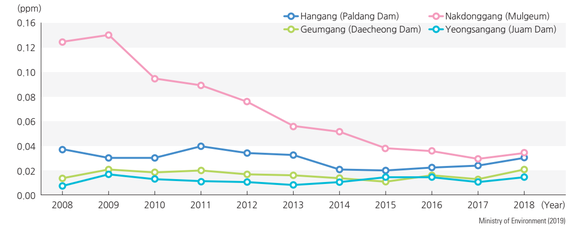
Water Pollution Level at the Four Major Rivers

Biological Oxygen Demand (BOD) by Year



Ministry of Environment (2019)

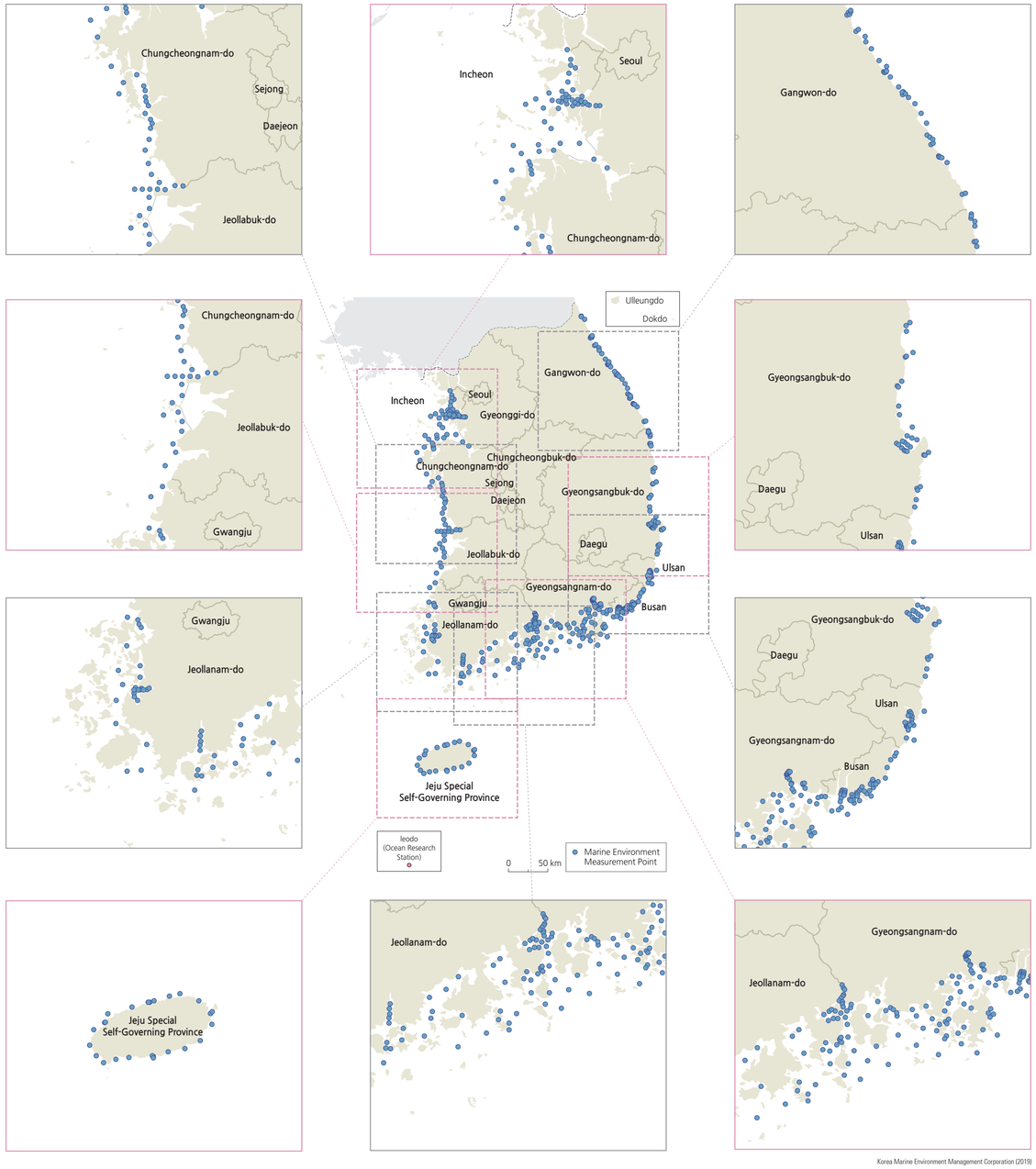
Total Phosphorous (T-P) by Year



Ministry of Environment (2019)

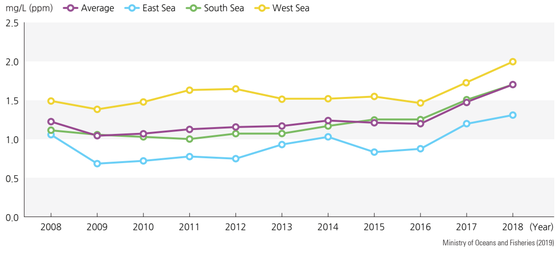
The water quality monitoring network is operated to understand the status of water quality and aquatic ecosystems in public water bodies such as rivers and lakes. As of 2019, water quality monitoring is carried out at a total of 2,249 sites. Data on water pollution are publicized through the "Water Resources Management Information System" (www.wamis.go.kr). Also, to protect the water quality of the water source, a water-source protection area with a total area of 1,136 km^2 is designated under the Water Supply and Waterworks Installation Act. Discharges of hazardous chemicals, waste, sewage, and excreta are prohibited at the site. As a result of these efforts, the water quality of the four major rivers is gradually improving, while biochemical oxygen demand (BOD) and total phosphorus (T-P), which are indicators of eutrophication, are decreasing. The amount of wastewater is low around Yangpyeong-gun, Gyeonggi-do, in the Han River basin. It is relatively high in Nam-gu of Ulsan and Gumi of Gyeongsangbuk-do, which were excluded from the protected area.

Distribution of Marine Environment Observatories



Korea Marine Environment Management Corporation (2019)

Chemical Oxygen Demand (COD) of National Coasts by Year



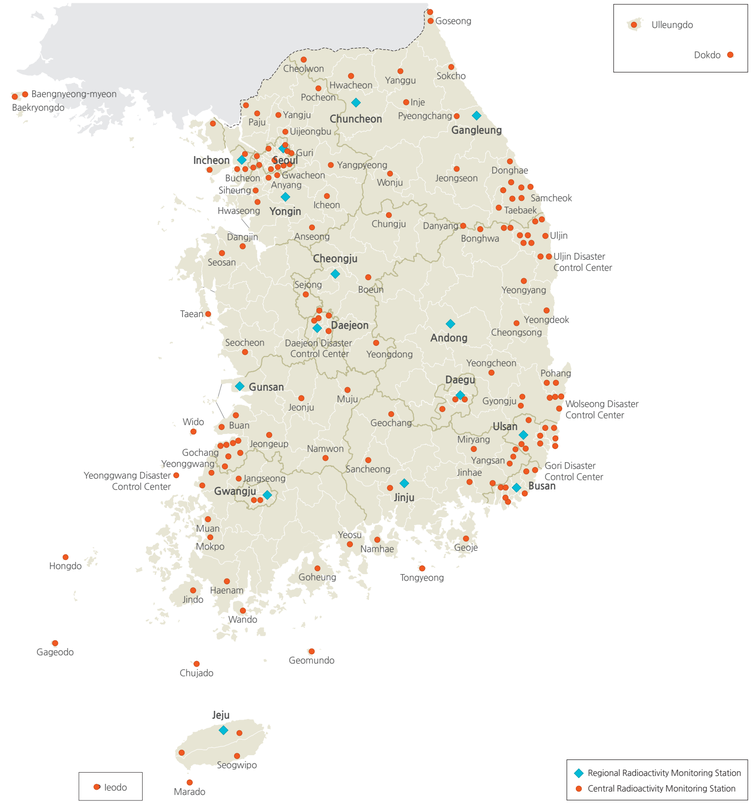
Ministry of Oceans and Fisheries (2019)

South Korea regularly monitors its marine environment and conditions of coastal waters, as well as the sources of marine pollution. The marine environment monitoring network aims to comprehensively understand the marine environment, and the collected information is used to establish national management and conservation policies.

This monitoring network comprises four different network types: coastal ports, offshore ports, environmental management waters, and estuaries. The monitoring is carried out in February, May, August, and November of every year at a total of 425 stations. The automatic network of seawater quality monitoring collects data from Sihwaho, Masanman, Ulsanman, Yeosu New Harbor, and the coastal areas of Busan to measure the water quality of estuaries and pollution hot spots and to monitor coastal pollution. The information from these monitoring networks is provided through the "Marine Environment Information System" (www.meis.go.kr). In the last two or three years, coastal pollution has increased steeply.

Other Environmental Monitoring

Distribution of Environmental Radiation Monitoring Stations



Korea Institute of Nuclear Safety (2018)

Environmental radioactivity refers to radioactive materials that are produced from nature as well as human-made sources. Radioactive contamination and exposure can lead to birth defects, cancer, and mental trauma because of how radiation affects the human mind and body. Radioactivity is monitored automatically by national environmental radioactivity monitoring stations, which control and manage disasters related to nuclear and radiation exposure and prepare responsive measures. The Korea Institute of Nuclear Safety constantly monitors changes in levels of environmental radiation and radioactivity through surveillance networks across the country.

There are 15 regional radioactivity monitoring stations and 155 central radioactivity monitoring stations that periodically measure particles, radioactive fallout, and beta and gamma nuclides from precipitation. Data are collected in real-time to observe changes in radiation levels and provided to the public through the "Integrated Environmental Radiation Monitoring Network" (https://iernet.kins.re.kr/).

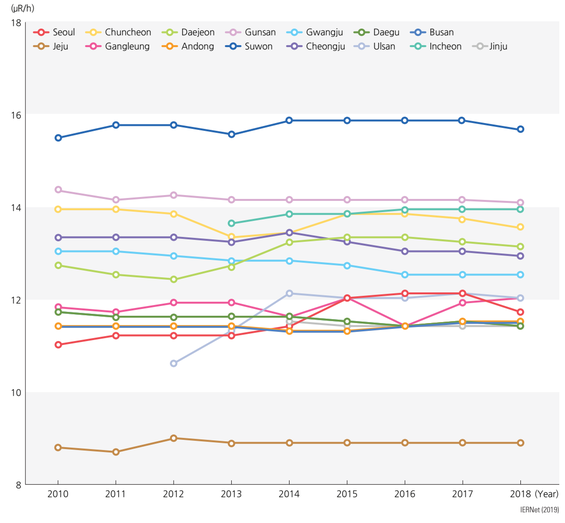
Radiation Monitoring Station, Seoul

Radiation Monitoring Station, Jinju-si

Radiation Monitoring Station, Cheonan-si

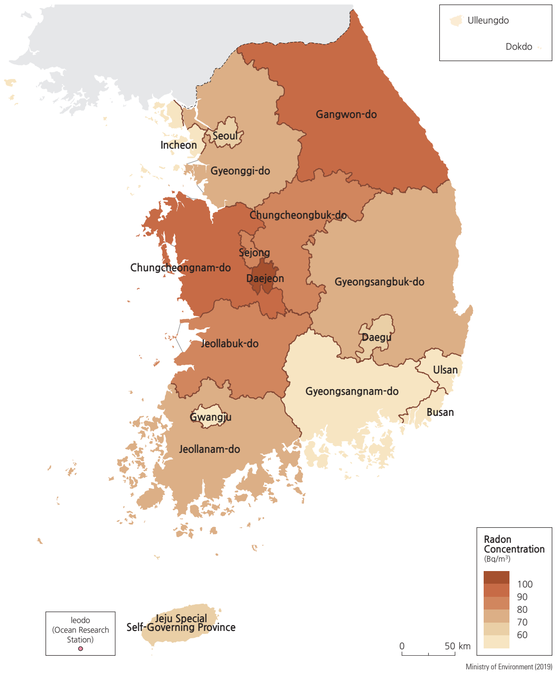
Additionally, since 2008 the Ministry of Environment has been measuring indoor radon concentrations after establishing Comprehensive Measures for Indoor Radon. Radon is a radioactive material that has recently been widely regarded as the cause of lung cancer, and its danger has been greatly highlighted. The Indoor Air Quality Control Act set an acceptable radon level (i.e., standard limit) at 200 Bq/m^3 or less when the Act was first made. However, since July 2019, the level has been set to 148 Bq/m^3 or less. As of winter 2018, the radon concentration in houses is the lowest in Busan and the highest in Daejeon, but all are below the standard.

Average Annual Rate of Spatial Gamma Dosage by Year



IERNet (2019)

Housing Radon Concentration by Province

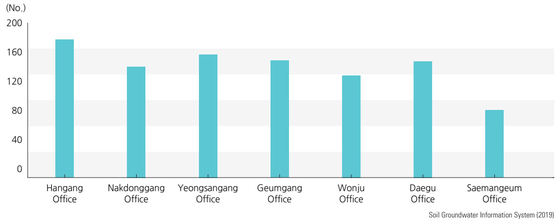


Ministry of Environment (2019)

Cadmium (Cd), lead (Pb), and petroleum are also types of carcinogens. These contaminate not only soil and groundwater but also crops and can cause fatal damage to humans. Aware of these issues, the Ministry of Environment has been monitoring national soil contaminants since 1987 as reference points to establish policies for soil contamination prevention, purification, and restoration. The soil monitoring network was expanded from 250 locations (five stations in each location) in 1987 to 3,000 in 1998. As of 2018, the network had been reorganized to 1,000 stations. The number of items of data collection, such as cadmium (Cd) levels and soil acidity (pH), were increased from 9 items in 1987 to 12 as of today.

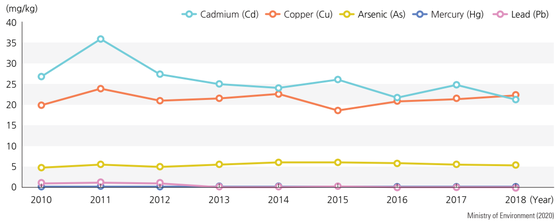
Since January 6, 1996, the nation and local governments have operated the networks of soil measurement. In the 2010s, soil pollution by heavy metals such as cadmium and lead continuously decreased. By region, cadmium and lead pollution levels are highest in Ulsan or Incheon, where industrial facilities are concentrated. Oil pollution is highest in Busan.

Number of Soil Contamination Measuring Points by Management Office



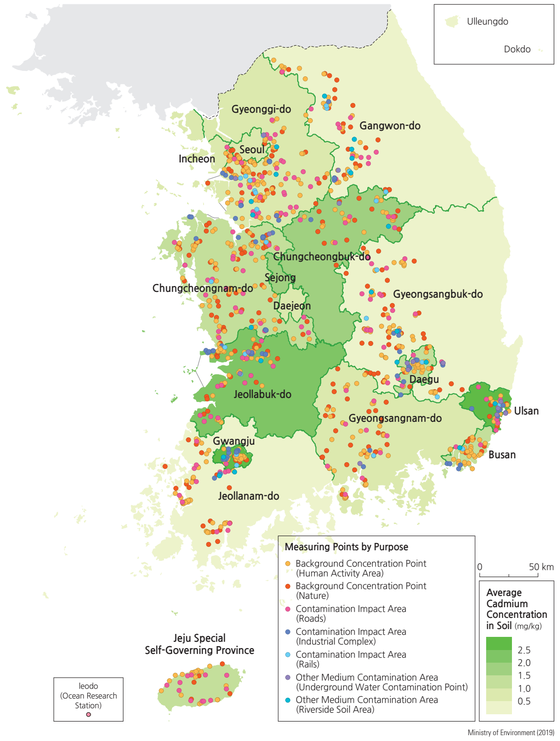
Soil Groundwater Information System (2019)

Soil Contamination by Year



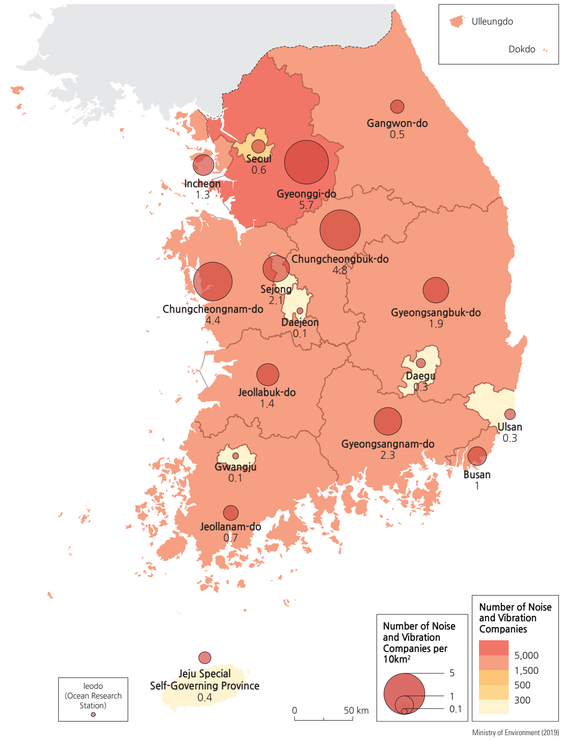
Ministry of Environment (2020)

Status of Cadmium Contamination in Soil by Province



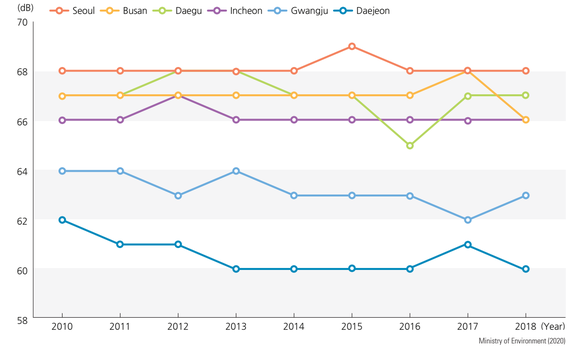
Ministry of Environment (2019)

Distribution of Companies Causing Noise and Vibration Emissions



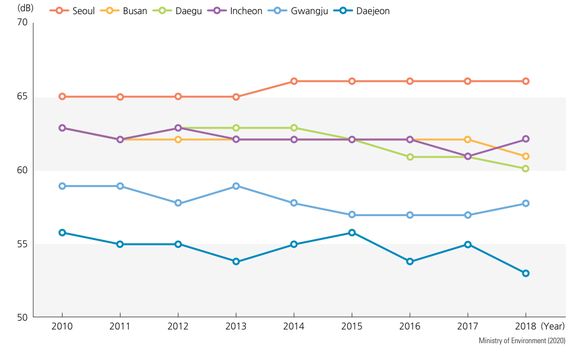
Ministry of Environment (2019)

Level of Ambient Noise in Major Cities (Day)



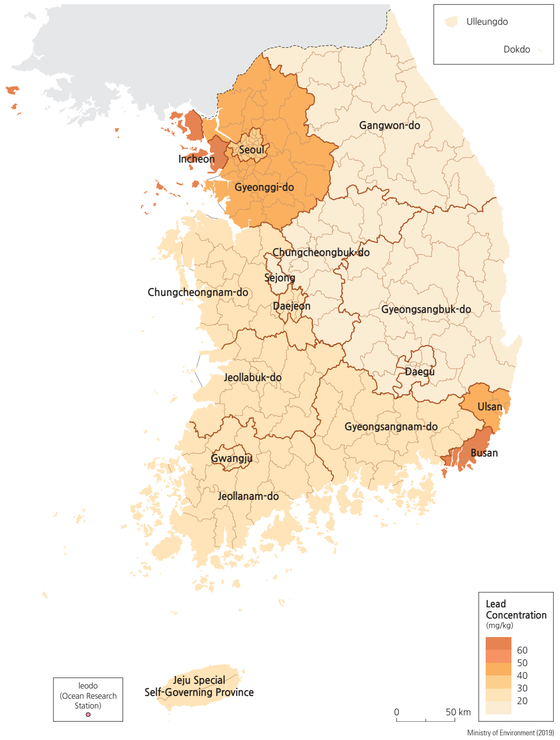
Ministry of Environment (2020)

Level of Ambient Noise in Major Cities (Night)



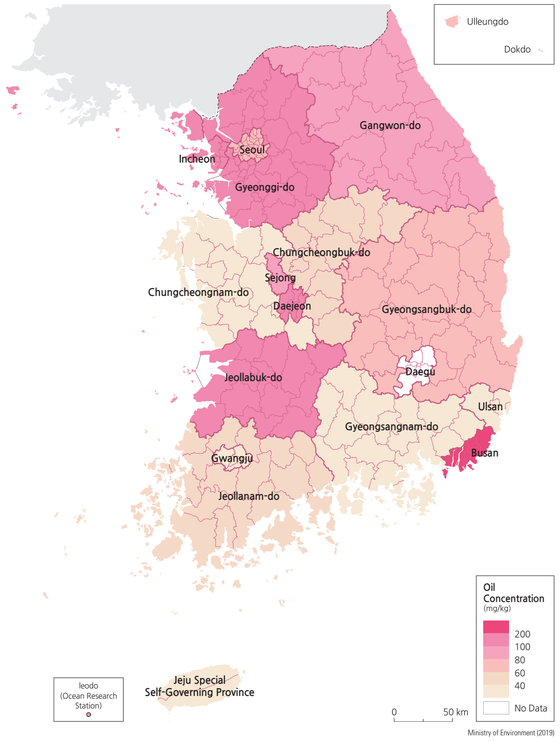
Ministry of Environment (2020)

Level of Lead Pollution by Province



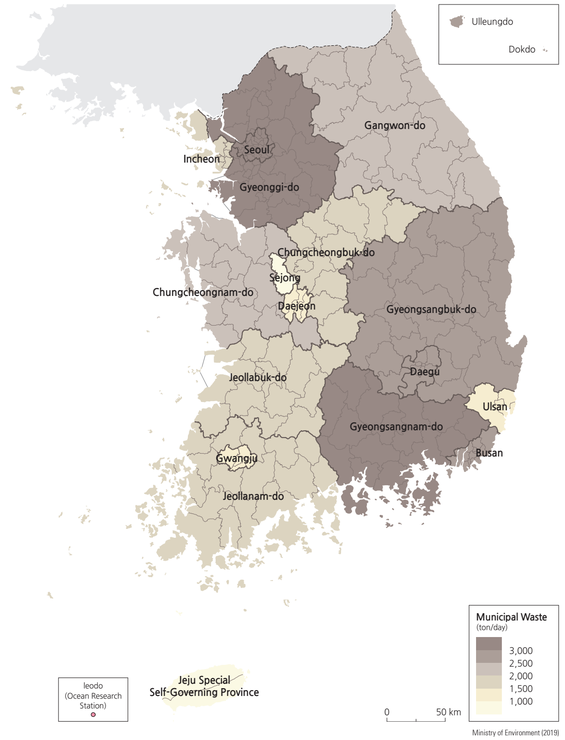
Ministry of Environment (2019)

Level of Oil (Total Petroleum Hydrocarbons) Contamination by Province



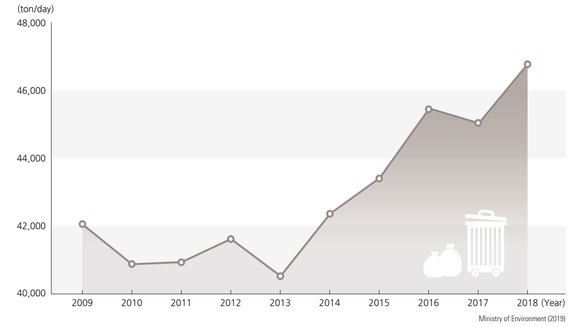
Ministry of Environment (2019)

Municipal Waste Generation by Province



Ministry of Environment (2019)

Estimate of Municipal Waste Generation



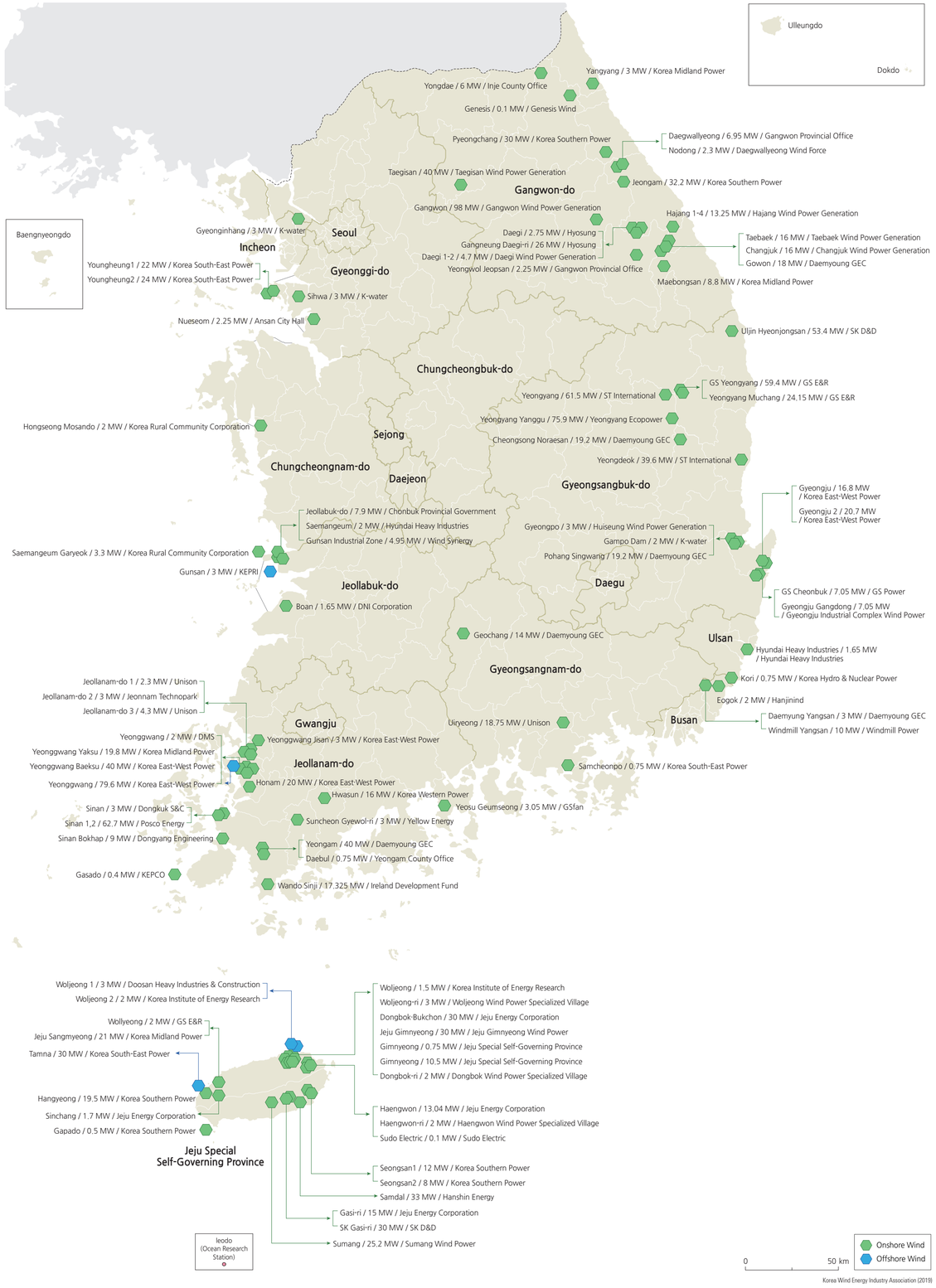
Ministry of Environment (2019)

As the population increases and urbanization intensifies, the damages caused by noise are also increasing. Whereas interest in the quality of life continues to grow, the desire for a quiet environment is prevalent. In 2018, the noise level in Daejeon and Gwangju cities during the day met the daytime environmental standard of 65 dB or less. For the nighttime standard, all metropolitan areas excluding Daejeon city were higher than the nighttime standard of 55 dB. The noise level has either shown a slight fluctuation within 1 dB, or has remained constant throughout urban areas for three years. In order to suppress noise pollution, soundproof infrastructures, traffic noise management policies, and other noise-reducing measures have been introduced.

Per Article 52 of the Noise and Vibration Control Act, the Ministry of Environment announces the number of businesses that emit noise and vibration in the 17 metropolitan areas. As of 2018, about 20,000 industrial facilities are concentrated in Gyeonggi-do, which is about half of the nation's industrial facilities. Gyeongsangnam-do and Chungcheongnam-do have about 4,000.

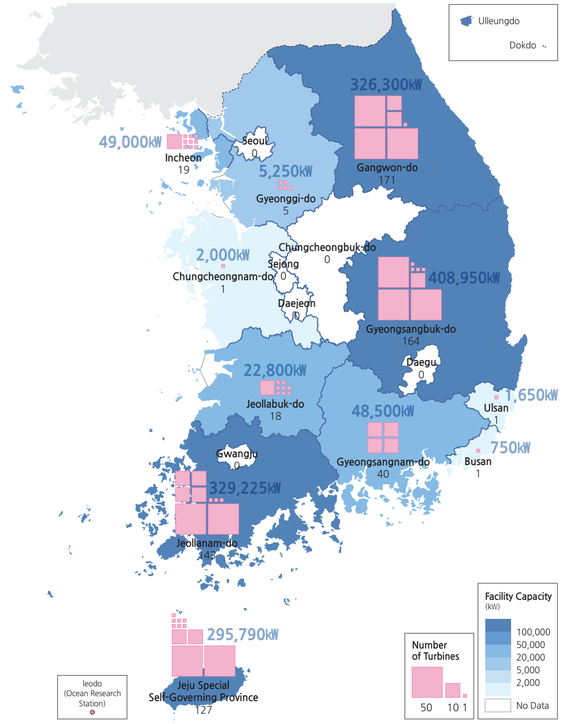
As of 2018, daily domestic waste is about 47,000 tons. In 2013, it was about 40,500 tons. It has been rising rapidly since 2014. This can be understood as a result of the significant increase in online shopping due to lifestyle changes. By city and province, Gyeonggi-do has the largest amount of daily domestic waste with 9,861 tons per day, followed by Seoul with 8,587 tons. Sejong Special Self-Governing City has the smallest amount of daily domestic waste at 320 tons per day, and Jeju Special Self-Governing Province has 964 tons of daily domestic waste. The densely populated Seoul, Gyeonggi, and Incheon account for about 44% of the total national daily domestic waste at 20,433 tons.

Wind Farm Status



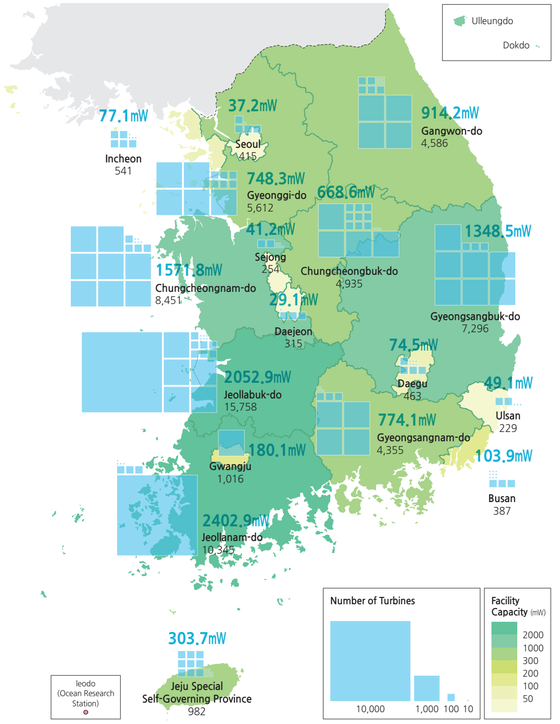
Korea Wind Energy Industry Association (2019)

Wind Power Facility Capacity and Number of Turbines by Region



Korea Wind Energy Industry Association (2019)

Domestic Solar Photovoltaic Status



Korea Energy Agency (2020)

As of 2019, there are 690 wind turbines in 103 complexes in South Korea. The total capacity of power generation supplies about 1,490.2 megawatts (mW). Wind farms are mainly distributed in the Taebaek Mountains in Gangwon-do, Nakdongjeongmaek in Gyeongsangbuk-do (Yeongyang-Cheongsong-gun), coastal areas in Pohang and Ulsan, and the southwestern coastal area of Jeollanam-do, and Jeju-do. There are relatively few wind farms in Gyeonggi-do, Chungcheongnam-do, and Chungchongbuk-do, which is due to differences in wind direction by region. Considering the wind direction, Taebaeksanmaek and Nakdongjeongmaek are suitable for inland wind power generation and the Southwest Coast and Jeju Island are suitable for coastal and maritime wind power generation.

However, wind power can be polarizing, as evidenced by conflicts between residents or debates about the possible environmental damage during the installation process of a wind farm. The wind farm projects at Yeongyang and Cheongsong-gun are examples of this societal impact. A majority of the wind power facilities are not operated by residents. The wind power facility on Jeju Island is the only project that residents participated in.

Although wind farms are expected to increase significantly in the future according to the renewable energy expansion plan, there are no government or local governments' countermeasures to alleviate the controversy over residents' opposition and environmental damage. The proposed "Renewable Energy 2030 Implementation Plan" is delayed. In order to successfully expand wind power generation, it is necessary to prepare a support system that can help with the operation of wind farms while addressing the interests of local residents and minimizing conflict.

The electricity produced by domestic photovoltaic power plants amounts to a total of 11.3 gigawatts (11,377.9 mW). During the same period, wind power generation capacity was 1.4 gigawatts. When comparing the two capacities, from the standpoint of the current government, solar power generation is more effective and important. In general, large-scale wind power plants can produce more electricity than solar power plants, but wind power generation sites have requirements that limit where they can be established, and the initial investment cost is higher. By contrast, solar power generation can be more extensive because there are more potential site options.

The generation capacity of solar power by province is, in the order of capacity, Jeollanam-do (2,402.9 mW), Jeollabuk-do (2,052.9 mW), Chungcheongnam-do (1571.8 mW), and Gyeongsangbuk-do (1348.5 mW). However, the number of power plants in Jeollabuk-do was 15,758, ahead of Jeollanam-do (10,345), though the size of the solar power plants in Jeollanam-do is larger on average.

Chungcheongnam-do has the third-largest solar power generating capacity among local governments at 1571.8 mW, while Gyeongsangbuk-do has the fourth-largest at 1,348.5 mW.

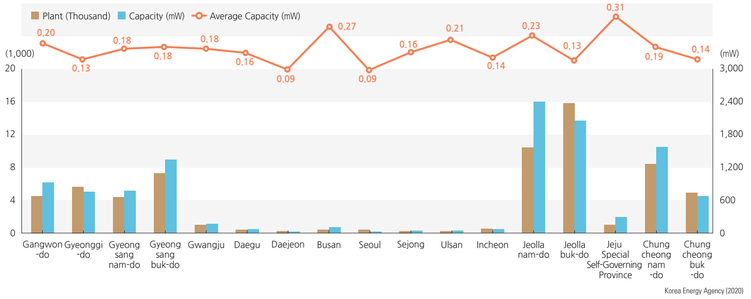
Local governments (Jeollanam-do, Jeollabuk-do, and Chungcheongnam-do) with a large capacity for solar power generation have the generators installed in flat places where the altitude is not high compared to other regions. In particular, Jeollanam-do and Jeollabuk-do had relatively low land prices compared to other regions, making it relatively easy to install facilities for solar power generation.

Local governments with a power generation capacity of less than 1,000 mW are Gangwon-do (914.2 mW), Gyeongsangnam-do (774.1 mW), Gyeonggi-do (748.3 mW), and Chungcheongbuk-do (668.5 mW). The number of power plants is 4,586 in Gangwon-do, 4,355 in Gyeongsangnam-do, 5,612 in Gyeonggi-do, and 4,935 in Chungcheongbuk-do. Jeollanam-do and Jeollabuk-do have many fewer by comparison. Meanwhile, the average local government power-generating capacity by power plants is highest in Jeju, where 982 power plants generate about 303.7 mW of electricity.

In the future, solar power generation facilities in the form of power generation complexes are planned to be built mainly in places with low salinity production, such as salt-affected reclaimed land. Jeollanam-do, Jeollabuk-do, and Chungcheongnam-do have many reclaimed land areas on which to build a large-scale solar power generation complex.

As with the developments of wind farms, local residents may object when developing a solar power plant. With the rapid increase in the number of solar power generation facilities in mountain regions by 2018, environmental disturbances and landscape deterioration have also emerged as serious social problems. The government reinforced the standards for solar power generation in the mountains by establishing the "Environmental Review Guide for Onshore Solar Power Generation" (Ministry of Environment, 2018). Since then, the number of solar power construction sites in the mountains has declined. In the future, it seems important to find new ways to reduce environmental damage—for example, the installation of photovoltaic sites in agricultural and urban areas.

Photovoltaic Power Plants by Province



Korea Energy Agency (2020)

Environmental Issues and Actions

Chronological Table of Environmental Issues

- 1969 — Ulsan Samsan Plain: Crop Damage
- 1979 — Yeocheon-dong, Ulsan-si: Outbreak of Skin Disease
- 1985 — Outbreak of the Onsan Disease
- 1987 — Hwaseong-si: Outflow of Pollutants from Industrial Waste Landfill
- 1989 — Seoul Metropolitan Area: Heavy Metals in Drinking Water
- 1991 — • Wonjin Rayon Occupational Disease • Gunsan: Dongyang Chemical TDI Spill • Nakdonggang: Phenol Spill Incident
- 1993 — Anmyeondo: Nullification of Nuclear Waste Disposal Site
- 1994 — • Sihwaho Incident • Model Implementation of a Volume Rate System for Waste Disposal
- 1995 — • National Implementation of a Volume Rate System for Waste Disposal • Oil Spill Accident of Sea Prince
- 1998 — Shooting Range Issue of Maehyang-ri, Hwaseong-si
- 2000 — Donggang Dam Annulled
- 2001 — Campaign against Construction of Road through Bukhansan
- 2003 — Nuclear Waste Site Annulled of Buan-gun
- 2007 — Oil Spill Accident of Hebei Spirit
- 2012 — Hydrofluoric Gas Leakage of Gumi-si
- 2018 — Gariwangsan Mountain Development for Winter Olympic

Gunsan Dongyang Chemical Toluene Diisocyanate (TDI) Spill

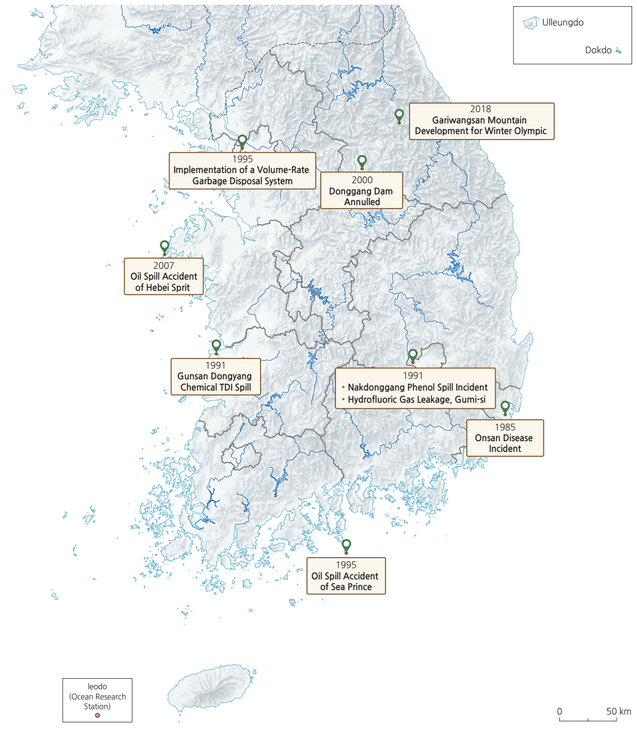
On September 7, 1991, concentrated waste fluids were leaked from Dongyang Chemical plants located in Gunsan-si due to the inexperienced operation of water sealing tanks. Substances assumed to be toluene diamine (TDA) and Tar were discharged along with hydrogen and water vapor. The leak resulted in the pollution of surrounding areas, thus triggering an environmental movement for the demolition of the chemical plants. Along with the Nakdonggang phenol spill, this incident was the driving force behind an early settlement in policies concerning hazardous substance management.

Oil Spill Accident of Sea Prince

Oil Spill Accident of Hebei Spirit

The Heibei Spirit oil spill (also known as the Taean oil spill) occurred on December 7, 2007, when the Heibei Spirit, a Hong-Kong-registered oil tanker, collided with a barge owned by Samsung C&T Corporation off the coast of Taean-gun, Chungcheongnam-do. As a result, 78,918 barrels of crude oil leaked into the waters, spreading out across the entire western coastal area. The Korean government declared six regions in Chungcheongnam-do as special disaster areas and enacted a special act. Meanwhile, about 2 million volunteers took part in the efforts to clean up the crude oil spillage.

Major Environmental Issues



On July 23, 1995, the Sea Prince oil spill occurred 8 km east of Nam-myeon, Yeocheon-gun, and Jeollanam-do. While attempting to evade the A-class typhoon, Faye, the Sea Prince (a Cypriot crude oil tanker) collided with Jakdo Island, causing consecutive explosions that damaged the engine room, the engine, and the bridge. The tanker eventually ran aground on Sorado, about 8 km west of Jakdo. The accident resulted in 5,000 tons of bunker A/C oil and crude oil being spilled, polluting 3,295 ha of ocean and 73 km of shoreline. This incident called attention to the grave repercussions of marine pollution and showed the urgent need to establish a response system for domestic marine pollution accidents.

Implementation of a Volume-Rate Garbage Disposal System

The volume-rate garbage disposal system was implemented in January 1995 as part of a waste minimization policy. It was introduced to reduce the amount of garbage generation and to promote the separate disposal of recyclable wastes. The system was based on the polluter-pays principle, under which liabilities are proportional to the amount of disposed waste. Although the system has managed to achieve the desired outcomes—reduced garbage disposal and increased recycling rates—problems such as illegal incineration and dumping of wastes have also emerged.

Winter Olympics Ski Resort Construction and Gariwangsan Mountain Development

Gariwang Mountain, located in Jeongseon, started to be developed in 2013 to build the alpine ski resort for the 2018 Pyeongchang Winter Olympics. During development, 78.3ha, approximately 3% of the total land area of Gariwang Mountain, was destroyed. The side in favor of the development argued that Gariwang Mountain was the only place that met the conditions of the stadium proposed by the International Ski Federation. On the other hand, opposing parties emphasized that Gariwang Mountain is a primeval forest preserved for over 500 years. As of 2020, two years after the Winter Olympics, the conflict over restoration and preservation continues.

Onsan Disease Incident

Onsan disease, the first pollution-related disease outbreak in Korea, stems from the Onsan National Industrial Complex constructed near Onsan-eup, Ulju-gun, and Ulsan-si in 1974. Local residents living near the complex of refinement plants for nonferrous metals began to show unusual health symptoms in the early 1980s. The incident gained public attention through media coverage in 1985, and vigorous local environmental movements led the government to officially recognize the harmful consequences of pollution. Beginning in 1986, the government designated the complex and its surrounding areas as a special countermeasure area to pollution and relocated the residents.

Donggang Dam Annulled

The government officially designated the proposed site for the construction of Donggang Dam in September 1997, which received a public objection from environmental movement organizations. The Ministry of Construction and Transportation and Korea Water Resources Corporation (K-water) strongly argued for the inevitability of the construction, and the rift between local residents, municipalities, and environmental movement groups only deepened through debates. In August 1998, the Ministry of Environment expressed concerns about the potential degradation of water quality due to the construction of the dam. It became a global environmental issue, wherein Greenpeace and the Sierra Club sent a clear message of objection to the Korean government. Consequently, a special investigation unit was organized to examine the validity of the Donggang Dam construction. The unit split up into subgroups and led research on water supply and demand, floods, dam security, environment, and culture. The conclusion drawn from the research was in favor of preservation, and in August 1999, even the President made a declaration against the construction. As a result, the plan for Donggang Dam was annulled, and the Donggang watershed was designated as an ecosystem reserve. This paved the way for the transition from controlling and using water to managing water at an ecosystem/environmental conservation level.

Nakdonggang Phenol Spill Incident

The first phenol pollution occurred on March 16, 1991, when underground pipes ruptured and spilled 30 tons of crude phenol at a Doosan Electronics plant in Gumi-si, Gyeongsangbuk-do. The leaked phenol was discharged into the Dasa intake station, which served as the source of drinking water for almost all areas of Daegu. Some residents suffered from headaches and vomiting due to the contamination. The second phenol pollution incident happened on April 22 of the same year, merely five days after Doosan resumed operations. Poor construction caused phenol tanks to burst, and crude phenol was leaked into Nakdonggang. Not only did the crisis disrupt the supply of drinking water in Daegu, but it also affected all areas of Yeongnam, including Milyang, Haman, Busan, and Masan. Concerns were raised over the effectiveness of the inspection criteria for drinking water standards and consequently triggered the enactment of the Act on Special Measures for the Control of Environmental Offenses.

Hydrofluoric Gas Leakage of Gumi-si

On September 27, 2012, hydrofluoric gas was leaked from Hube Global plants located in the 4th National Industrial Complex in Gumi-si, Gyeongsanbuk-do. The accident resulted in 23 casualties and also caused extensive damage to humans, animals, and plants in neighboring towns. The incident highlighted the lack of national response capacity for chemical accidents or disasters.

Environmental Perception and Policy Changes

1960s – 1970s

The Era of Emerging Environmental Problems and Initial Responses

In 1967, the average concentration of bacteria and colon bacillus in Hangang was about 150 times higher than that of 1963. Deformed fish were caught in the river, and the BOD level downstream of Jungnangcheon reached 374.9 mg/L in 1974. The first industrial pollution incident occurred in 1967 when sulfuric acid gas leaked from Yeongnam Chemical in the Ulsan Industrial Complex, causing respiratory diseases among local residents and the destruction of surrounding forests. In 1969, Korea Aluminum Co., Ltd. in the Ulsan Industrial Complex discharged fluorine and sulfuric acid gas, which devastated the rice crops of the Samsan Plain. The heavy chemical industry developed in the Yeocheon and Gwangyang regions resulted in the contamination of Gwangyangman along with mass deaths of fish and shellfish. In 1978, children living in this area suffered from skin diseases of unknown causes. As such, a movement to actively respond to environmental problems began, centering on those who have been damaged by subsequent pollution.

1980s

The Beginning of Environmental Management

The constitution of the Fifth Republic of Korea in the 1980s defined "Environmental Rights" as fundamental rights of the people to live in a healthy and pleasant environment. Thus, the environmental sector plan was established for the first time, breaking away from previous national development policies that focused solely on economic growth. In the 6th Five-Year Economic Development Plan (1987–1991), the objectives for environmental policy were set to "improve the achievement ratio of environmental standards." The main policies were strengthening environmental management in areas with a high possibility of pollution and improving urban living conditions to prepare for the 1988 Seoul Olympic Games.

1990s

The Advancement of Environmental Policies

As a departure from the 1980s policies of post-management and direct regulation, the government introduced a new paradigm for environmental policy that included a preventative management system and economic incentives. Following the Rio Conference in 1992, business organizations such as the Federation of Korean Industries proclaimed environmental management strategies. This elevated environmental conservation awareness and related activities in the industry led to a trend for environmentally friendly business management practices.

2000s

The Era of Practicing Sustainable Development Principles

In the 21st century, global management philosophies and development strategies have shifted away from economic growth to sustainable development. In particular, the World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002 set up the goals for the balanced development of environmental conservation, economic growth, and social development (the 3 major axes).

2010s

Expansion of Interest in a Living Environment

In the 2010s, interests in not only the natural environment but also the quality of life and living environment increased. As the scope of environmental policy has expanded, countermeasures have been taken against things that cause carcinogens such as asbestos, radon, and fine dust. For example, the Asbestos Injury Relief Act was enacted in 2011, and the Special Act on Remedy for Damage Caused by Humidifier Disinfectants was promulgated in 2017. Such legal arrangements were made for victim compensation. Since 2019, when the concentration of fine dust exceeds the standard, emergency reduction measures, such as driving restrictions for municipal and government vehicles and restrictions on the operation of old diesel vehicles, have been implemented.

- 1961 — Enacted the "Sewage Cleaning Law"
- 1963 — Enacted the "Pollution Prevention Act" (The First Environmental Law)
- 1967 — Enacted Subsidiary Legislation to the "Pollution Prevention Act"; Established the Environmental Sanitation and Pollution Department under the Minstry of Health and Social Affairs
- 1971 — Introduced the Green Belt System
- 1977 — Enacted the "Environmental Conservation Act" and "Marine Pollution Prevention Act"
- 1978 — Proclaimed the Charter of the Conservation of Nature
- 1980 — Opened the Environmental Office
- 1981 — Revised the "Environmental Conservation Act"; Expanded Target Organizations of the Environmental Impact Assessment
- 1984 — Organized the "Central Pollution Map Inspection Team" (Interim Mechanism for the Environmental Office)
- 1986 — Re-revised the "Environmental Conservation Act"; Enacted the "Waste Control Act" and the "Environmental Management Corporation Act"; Revised the "Marine Pollution Prevention Act"; Designated Ulsan and Onsan as "Areas of Special Measures for Air Pollution"
- 1989 — Completed 19 Sewage Treatment Plants; Planned the Construction of a Sanitary Metropolitan Landfill in Gimpo; Established the 1st Comprehensive Plan for Clear Water Supply
- 1990 — Divided the "Environmental Conservation Act" into the "Framework Act on Environmental Policy," "Clean Air Conservation Act," "Noise and Vibration Control Act," "Water Quality Conservation Act," "Toxic Chemicals Control Act," "Pollution Damage Dispute Mediation Act"; Promoted the Environment Office to the Environment Department
- 1991 — Established the "Natural Environment Conservation Act," "Law on Livestock Manure and Sewage Water Treatment," "Act on Special Measures for the Punishment of Environmental Offenses," "Environment Improvement Expenses Liability Act"
- 1993 — Enacted the "Environmental Impact Assessment Act"
- 1994 — Promoted the Environment Department to the Ministry of Environment; Revised the "Water Service Act" and the "Sewerage Act"; Enacted the "Act on Special Accounts for Environmental Improvement" and the "Environmental Technology Development and Promotion Act"
- 1995 — Established the Long-Term Environmental Conservation Master Plan (1996 – 2005) and Environmental Vision 21; Enacted the "Soil Environment Conservation Act"
- 1996 — Established Comprehensive Water Management Measures; Enacted the "Indoor Air Quality Control in Public Use Facilities, etc. Act"
- 1997 — Enacted the "Lake Water Management Act" and the "Special Act on the Preservation of the Ecosystems in Island Areas Including Dokdo"
- 1998 — Established Special Measures for the Conservation of Paldang Drinking Water
- 1999 — Enacted the "Act on the Improvement of Water Quality and Support for Residents of the Riverhead of the Han River System" and the "Wetlands Conservation Act"; Established Comprehensive Measures for Nakdonggang Water Management
- 2000 — Declared the Millennium National Environmental Vision; Established the Hazardous Chemicals Management Plan
- 2003 — Enacted the "Special Act on the Improvement of Air and Environment for Seoul Metropolitan Area"
- 2004 — Introduced a System for Confirming and Handling Chemicals and Identifying Banned Substances; Enacted Comprehensive Measures for National Bio-Resource Conservation (2005 – 2014); Established a 10-Year Metropolitan Air Quality Improvement Master Plan (2005 – 2014); Established the Metropolitan Atmosphere Environment Office
- 2005 — Proclaimed the National Sustainable Development Vision; Introduced a System of Restricted Materials; Strengthened the Protection Scheme of Endangered Wild Fauna and Flora
- 2006 — Established the 10-Year Comprehensive Plan for Environmental Health; Declared the First Year of Environmental Health; Established a Restoration Plan for Endangered Wildlife; Established the 10-Year Comprehensive Plan (2006 – 2015) to Improve Air Quality
- 2008 — Established the Basic Comprehensive Climate Change Plan (2008 – 2012)
- 2009 — Launched a Health Impact Assessment (HIA) System and Stage 1 of the National Environmental Health Survey; Prepared Comprehensive Asbestos Management Measures
- 2010 — Established the Greenhouse Gas Information Center
- 2011 — Enacted the "Asbestos Damage Relief Act" and the "Asbestos Safety Management Act"; Introduced a Geological Park System and the 1st Primary Resource Recycling Plan (2011 – 2015); Held the 10th Conference of the Parties on UNCCD
- 2013 — Established Comprehensive Chemical Safety Management Measures and Chemical Safety Facilities; Opened the Nation Institute of Ecology; Enacted the "Act on Registration, Evaluation, etc. of Chemicals"; Revised the "Chemicals Control Act"
- 2014 — Enacted "Act on Liability for Environmental Damage and Relief Thereof"; Held the 12th Conference of the Parties on Biological Diversity
- 2015 — Implemented the National Greenhouse Gas Emissions Trading System
- 2017 — Enacted the "Special Act on Remedy for Damage Caused by Humidifier Disinfectants"
- 2018 — Enacted the "Special Act on the Reduction and Management of Fine Dust"
- 2019 — Launch of the "National Council on Climate and Air Quality"

Korea Green Foundation (2012), Ministry of Environment (2020)

International Cooperation

Sustainable development is the most frequently cited term at international conferences in the 21st century. Humanity and the global ecosystem have suffered many difficulties due to environmental destruction caused by excessive economic development after the Industrial Revolution. To mitigate these impacts, global leaders, governmental representatives, international organizations, and NGOs gathered together under the supervision of the United Nations to discuss sustainable development, which means to continue development without damaging the global environment. The starting point was the Earth Summit (United Nations Conference on Environment and Development) held in Rio de Janeiro, Brazil, in 1992. In this meeting, leaders around the world jointly adopted the Rio Declaration on Environment and Development and Agenda 21.

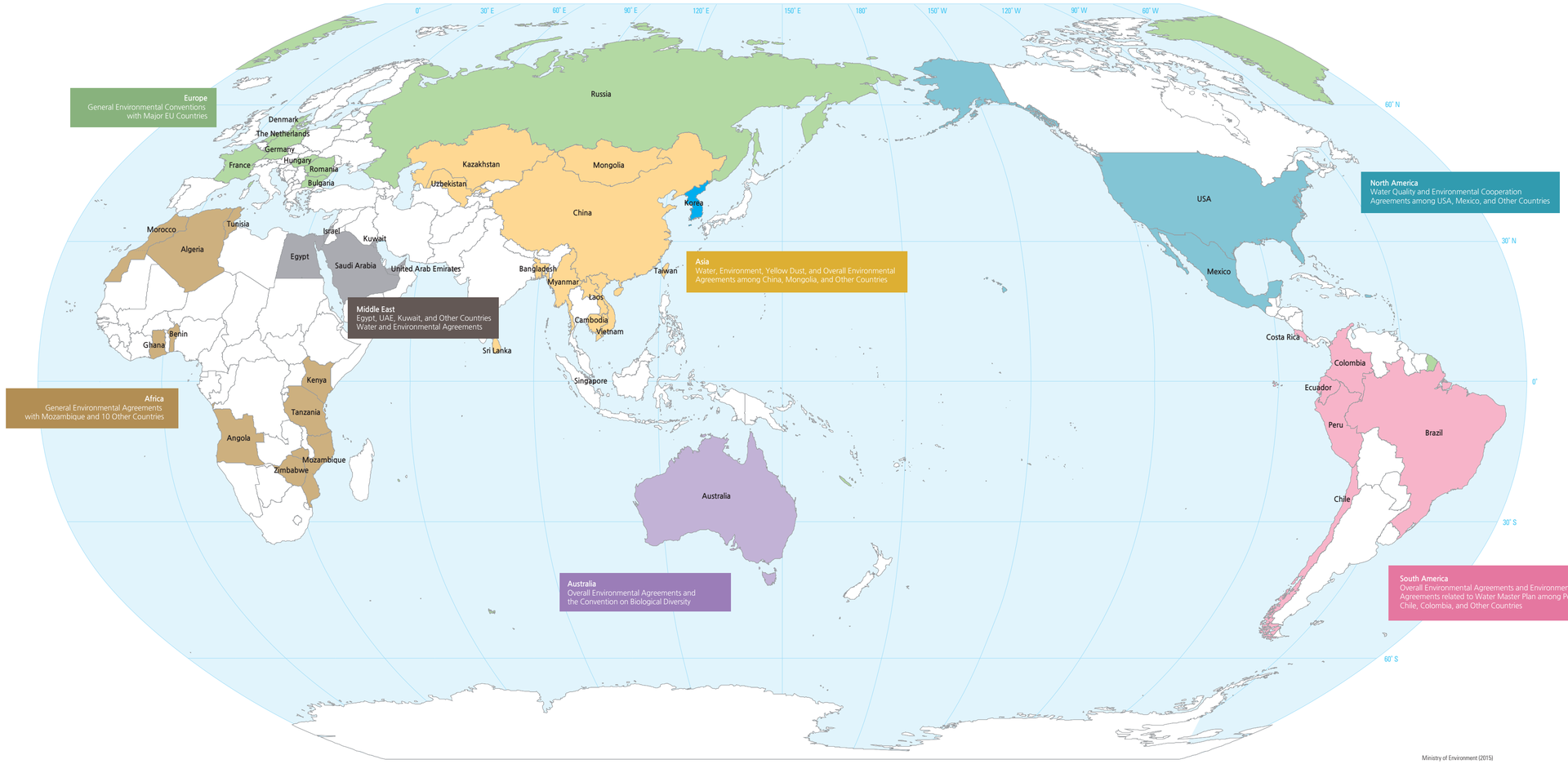
Subsequently, at the 21st Annual Conference of Parties (COP) in 2015, the Paris Agreement was adopted. Its goal is to limit global warming, preferably to 1.5 degrees Celsius. In this trend, South Korea is striving to implement sustainable development through national laws and policies such as the Framework Act on Sustainable Development and Framework Act on Low Carbon Green Growth. It is also flexibly responding to changes in international discussions through opportunities such as the subsequent Sustainable Development Goals (SDG) and the High-Level-Political Forum (HLPF).

Environment Related International Cooperation

United Nations Conference on Environment and Development (Rio Environmental Conference, 1992, Rio, Brazil)	• Rio Declaration and Agenda 21; Adopted the Convention on Climate Change, the Convention on Biodiversity, and Developed the Convention to Combat Desertification	World Summit on Sustainable Development (Rio+10, 1992, Johannesburg, South Africa)	• Adopted the Johannesburg Declaration and the Johannesburg Plan of Implementation	UN Sustainable Development Summit (Rio+20, 2012, Rio, Brazil)	• Agreed on the Sustainable Development Goals (SDG) • The Establishment of a High-Level Political Forum on Sustainable Development	21st Conference of the Parties (COP21, 2015, Paris, France)	• Paris Agreement Signed; Laying the Foundation for a Bottom-Up New Climate System
UN Convention on Climate Change	Joined on June 13, 1992 (Effective from March 21, 1994)	UN Convention on Biodiversity	Joined on October 3, 1992 (Effective from January 1, 1995)	Established the UN Convention to Combat Desertification	Joined on August 17, 1999 (Effective from November 15, 1999)		

The Ministry of Foreign Affairs (2020)

Countries Under Environmental Agreements

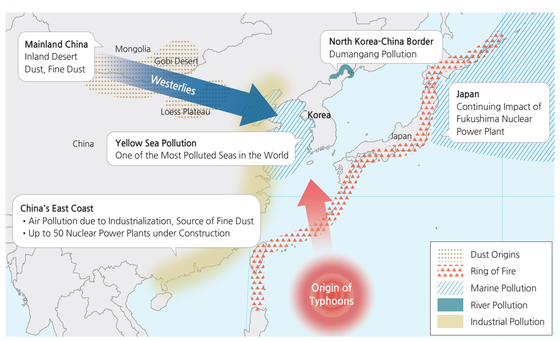


Ministry of Environment (2015)

Every country in Northeast Asia faces different environmental challenges because of their different natural environmental conditions and distinct socio-economic situation. South Korea and Japan share environmental problems that can generally be seen in developed countries; their advanced industrial structures have led to increases in energy consumption and the number of private vehicles. North Korea and Mongolia experience environmental damage problems that are brought about by poverty. North Korea is undergoing serious environmental damage as a consequence of forest degradation due to food and energy shortages. Mongolia and western China are affected by desertification, while recent rapid industrial development in the eastern part of China has caused serious air and water pollution.

Such environmental problems in Northeast Asia also affect neighboring countries. For instance, yellow dust originating from the Gobi Desert and the Loess Plateau picks up pollutants such as fine dust and nitrogenous compounds as it crosses the rapidly industrialized east coast of China. It then reaches Korea and Japan. The pollution of international seas and streams such as the Yellow Sea and Dumangang is also being discussed as one of the most important environmental issues in this region. Radioactive water from the Fukushima nuclear power plant in Japan is leaking into the waters, increasing international concern about pollution in the North Pacific. In the future, such transboundary disasters will be frequent in Northeast Asia. Not only are the nations of Northeast Asia located on the same plate boundary, but they are also affected by various disasters through westerly winds, currents, and typhoons. Many nuclear power plants are being built even though they are located close to the boundary of the plate, so there is a risk of large-scale disasters.

Environmental Issues in Northeast Asia



Asia Center, Seoul National University (2015), Chosun Ilbo (2014)

Key Environmental Causes and Issues in Northeast Asia

Nations	Causes	Key Environmental Issues at the National Level	Key Environmental Issues of East Asia
Korea	- Unsustainable Energy Consumption - Lack of Emission Reduction Efforts - Increase in Private Vehicles - Habitat Destruction	- Air Pollution, Acid Rain - Water Pollution - Decrease in Fish Catch	Yellow Dust Air Pollution, Fine Dust Marine Pollution (Yellow Sea, Pacific Ocean) River Pollution (Yellow Sea, Pacific Ocean)
Japan	- Nuclear Power Plant Location in Disaster Risk Areas - Unsustainable Energy Consumption - Lack of Emission Reduction Efforts - Increase in Private Vehicles - Habitat Destruction	- Radioactive Contamination (Marine Pollution) - Air Pollution, Acid Rain - Acidification of Surface Waters	
China	- Relying on Low-quality Coal - Lack of Emission Reduction Efforts - Dry Climate in Northern China - Increase in Private Vehicles - Poverty	- Air Pollution, Acid Rain - Water Scarcity in Northern China - Water Pollution - Deforestation - Desertification - Trading of Endangered Species - Ineffective Environmental Laws	
North Korea	- Mountainous Environment - Lack of Emission Reduction Efforts - Habitat Destruction - Poverty	- Water Pollution - Lack of Available Water Resources - Waterborne Diseases - Deforestation	
Mongolia	- Dry Climate - Excessive Grazing - Deforestation - Reliance on Low Quality Coal	- Lack of Available Water Resources - Air Pollution - Deforestation - Soil Erosion and Degradation, Desertification - Pollution Caused by Mining	

Asia Center, Seoul National University (2013)

Environmental Cooperation with Europe and North America

To improve the national environmental status, South Korea has been promoting cooperation with advanced western countries such as the United States, France, Denmark, the Netherlands, and Germany to adopt advanced environmental policy and technology, based on the memorandum of understanding for environmental cooperation between countries. South Korea is actively promoting cooperation projects, such as activating expert exchange and holding joint seminars. Meanwhile, in 2013, per the "US-ROK Environmental Cooperation Agreement" effective in 2012, the US-ROK Environmental Affairs Council and Environmental Cooperation Commission held its first meeting in the United States. At this meeting, they discussed ways to jointly approach international environmental issues such as air quality pollution investigation and marine waste management. In 2019, at the third meeting, the two countries promised close cooperation regarding the investigation of the cause of fine dust, the development of sustainable marine fisheries, and the conversion of renewable energy.

Environmental Cooperation with Southeast Asia

Southeast Asia is also experiencing serious environmental problems due to rapid industrialization and urbanization. South Korea maintains a cooperative relationship with countries in the region. It provides practical help in improving the environment of Southeast Asian countries while also pursuing practical aspects by supporting smooth advancement of Korea's environmental industry into Southeast Asia.

Aiming for sustainable development in Asia, South Korea has been discussing sustainable development and environmental matters through the ASEAN+3 Environment Ministers Meeting, the Tripartite Environment Ministers Meeting among Korea, China, and Japan, and other cooperation initiatives with Vietnam, Cambodia, and Indonesia. At the 2019 ASEAN-ROK Commemorative Summit in Myanmar, the government of South Korea agreed to build the Korea-Mekong Biodiversity Center (Mekong-ROK Biodiversity Center) (to be completed in 2025). Also, by signing a memorandum of understanding for environmental cooperation with Myanmar, both governments promised to cooperate to resolve environmental issues such as climate change, air pollution, and the use of waste resources.

Tripartite Environment Ministers Meeting among Korea, China, and Japan

In 1999, the first Tripartite Environment Ministers Meeting among Korea, China, and Japan (TEMM) was held in Seoul of South Korea. Each country has annually hosted a meeting of the Environment Ministers in turn. Its objective is to devise cooperative measures to tackle East Asian environmental issues such as yellow dust, acid rain, atmospheric pollution, and hazardous waste management, and to raise a sense of environmental community among the three countries. This meeting is the only minister-level conference in the East Asian region and has served as the highest-level coordination mechanism on environmental cooperation. A total of 21 meetings have been held as of November 2019.

Northeast Asian International Cooperation for Yellow and Fine Dust

Responding to yellow dust and fine dust is an important environmental task for not only the nation but also the entire Northeast Asian region. Because it is one of the major environmental cooperation tasks in Northeast Asia, South Korea has actively pushed for a collective response to this issue, regarding it as a major agenda in national summit meetings, Korea-China-Japan ministerial meetings, and Northeast Asian environmental cooperation channels, and has demanded joint responses. In 2013 and 2014, three countries' yellow dust experts jointly investigated the Hulunbuir area of Inner Mongolia, China. The three countries plan to use this area as a base for the ecological restoration of desertified areas. In 2019, ROK-China Joint Committee on Environmental Cooperation and ROK-China Director-General-Level Meeting on Environmental Cooperation took place in South Korea. In the meetings, the two countries have coordinated their opinions to solve the fine dust problem by jointly establishing an early warning system for fine dust.

Environmental Cooperation with Africa

In Africa, recent environmental pollution is considered a major factor impeding economic development. Accordingly, people accept that the key to resolving regional poverty-related issues is to curtail economic growth to control environmental destruction. The Ministry of Environment of Korea has been holding the Korea-Africa Environmental Cooperation Forum every year since the groundwork for discussions on environmental cooperation between the two countries was laid in 2010.

In 2014, South Korea hosted a joint workshop with Tunisia along with the 5th Korea-Africa Forum, in which the vice-minister and director of the Tunisian Ministry of Environment, officials from Nigeria and Côte d'Ivoire, and Water and Sanitation for Africa discussed ways to share environmental policy and technology for atmospheric and waste management sectors. In 2017, South Korea also held the Middle East-Africa Environment Forum 2017. As of May 2015, the Korean government has signed MOUs on environmental cooperation with 11 African countries.