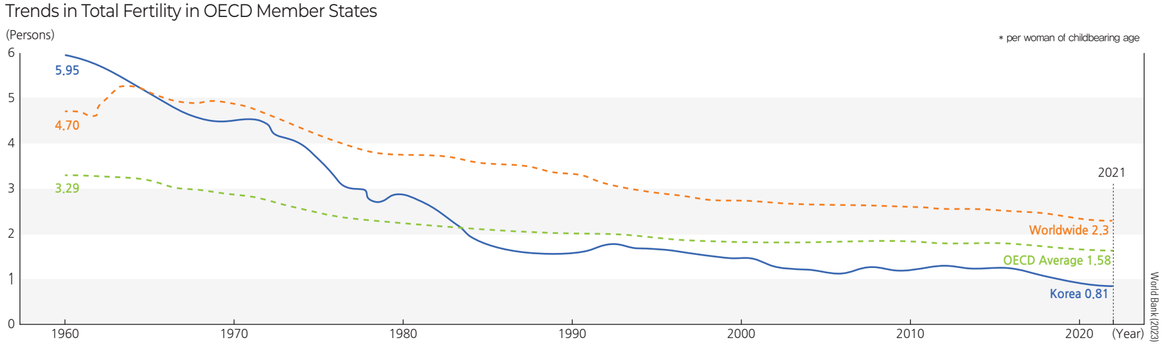
CHALLENGES AND POTENTIAL OF NATIONAL TERRITORY

Low Birthrate and Local Extinction

From 1955 to 1974, a period characterized by the baby boomer generation, South Korea had an annual birth rate exceeding 900,000, with a total fertility rate of over 4.0. In the early 1980s, the government implemented strong low birthrate policies, promoting various family planning slogans, which led to a significant drop in the total fertility rate to 2.06 by 1983—below the replacement rate of 2.1. Since then, except for a slight increase in the early 1990s and 2000, the total fertility rate has continued to decline steadily.

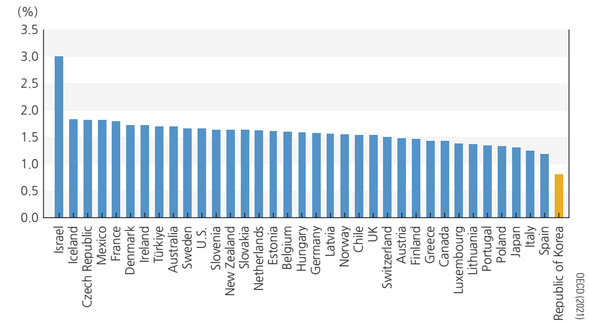
Trends in Total Fertility in OECD Member States



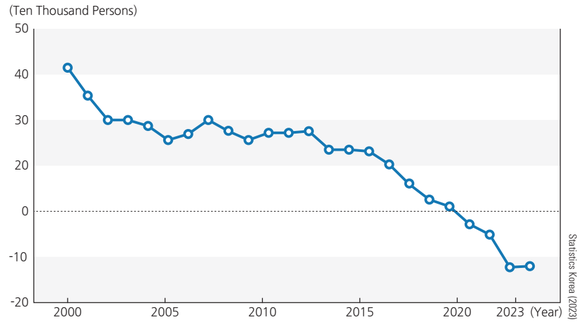
Total Fertility Rate of South Korea

South Korea's ongoing ultra-low birth rate, which began in 2002, ranked lowest among the 38 OECD countries and among 217 countries globally in 2021. The total fertility rate was 0.81 in 2021, significantly lower than the global average of 2.3 and the OECD average of 1.58. Excluding city-states, South Korea is the first country in the world to record a total fertility rate below 1.0. Due to low birth rates, the population has been naturally declining since 2020, and the demographic structure has shifted from a pyramid to a diamond shape due to a sharp decrease in the youth population.

Total OECD Fertility Rate



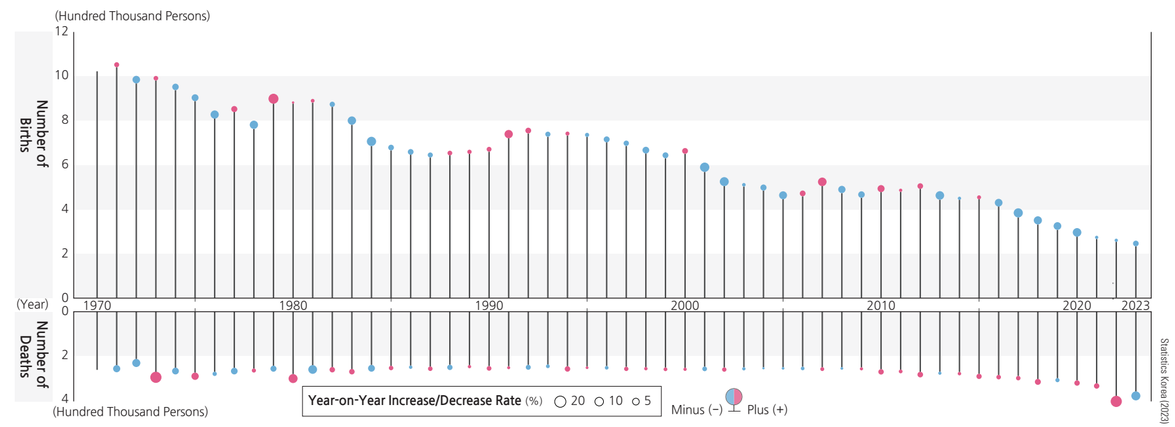
Natural Population Growth by Year



Change in the Population Pyramid

According to population trend statistics, except for the early 1980s and mid-1990s, the number of births has been steadily decreasing. The number of births, which was around 1 million in 1970, took about 30 years to fall below 500,000 (2002: 496,000) and about 20 more years to be nearly halved again (2020: 272,000). The year-over-year growth rate of births showed repeated increases and decreases from 1970 to 2015, but since 2015, a continuous decline has been observed. The number of deaths remained relatively stable from the mid-1980s to the late 2000s but increased between 2010 and 2020. Unlike births, the number of deaths generally shows an increasing trend. The natural population increase, calculated by subtracting the number of deaths from births, has continued to decline, reaching negative growth in 2020, where the number of deaths exceeded births (272,000 births vs. 304,000 deaths).

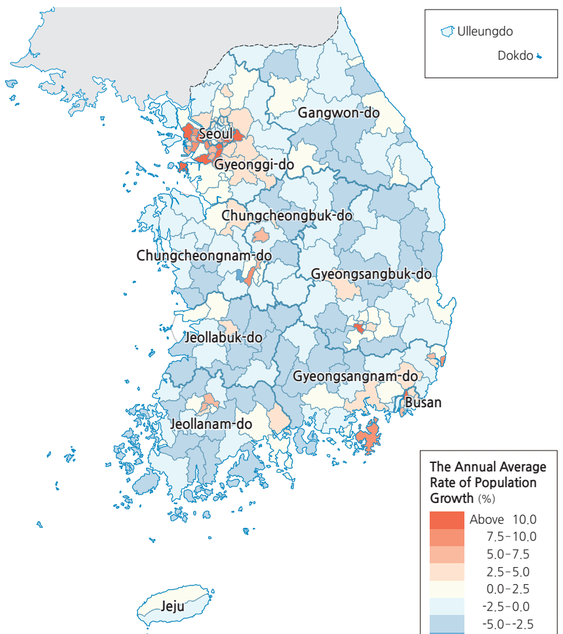
Births and Deaths



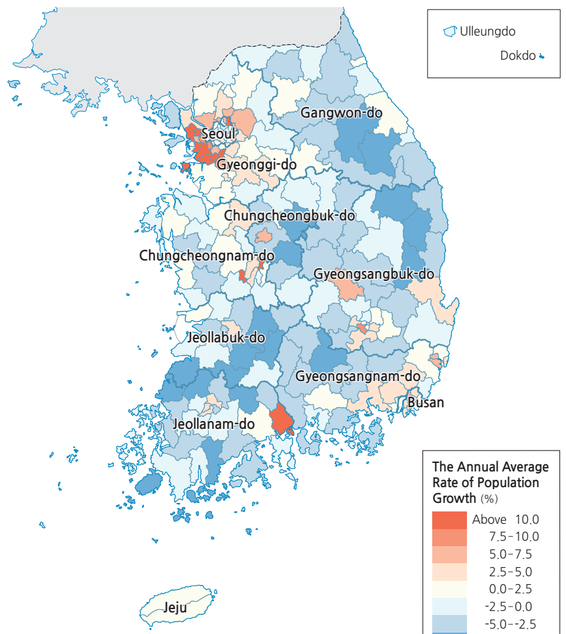
The average annual population growth rate (based on the total population) of South Korea, which was around 2–3% until the 1960s, was higher than the global average and the OECD average. However, it declined sharply from the 1970s to the mid-1980s and has continued to decrease to the present day (0.14% in 2020). Analyzing the five-year average annual change rate of the total population, there was a 1.01 percentage point decrease between 1980–1985 and 2005–2010. During the same period, the average annual population growth rate in the Chungcheong and Gangwon regions increased, but a decreasing population growth trend was observed in other regions. When considering only the domestic population, the change rate was similar to that of the total population between 1980–2005, but it was higher between 2005–2010.

Total Population Growth Rate

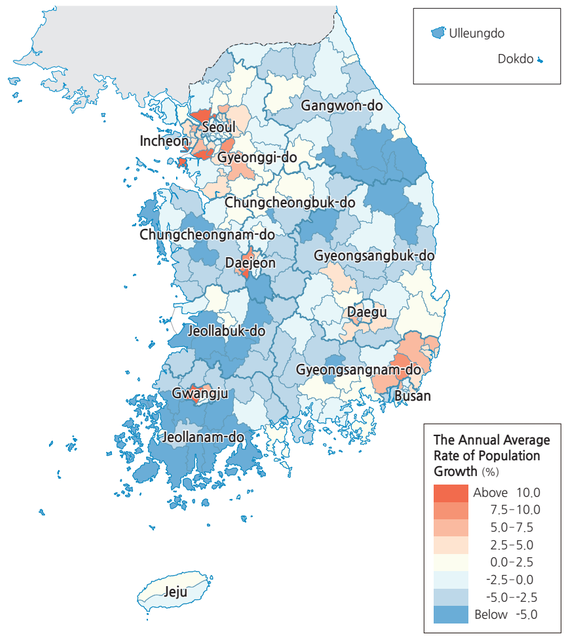
1980–1985



1985–1990

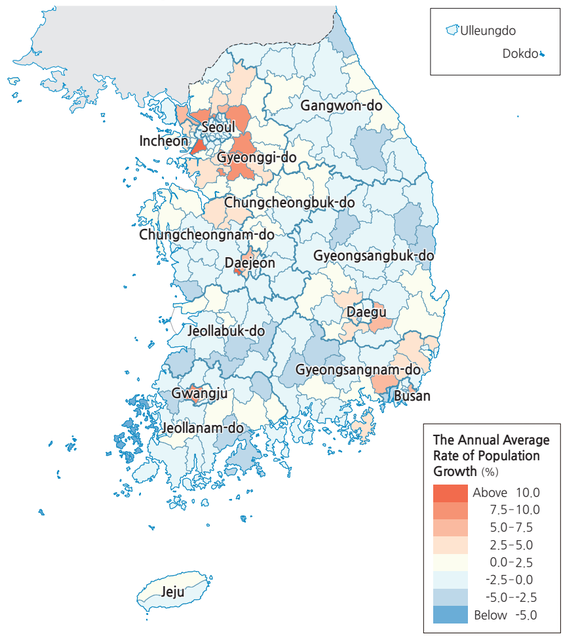


1990–1995

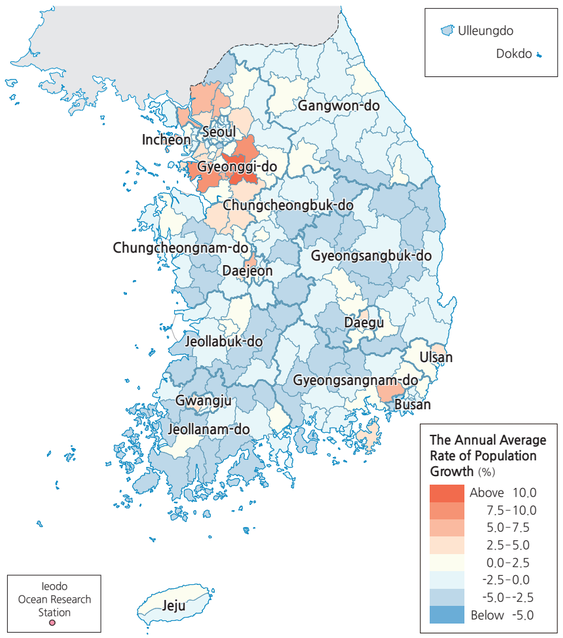


1995–2000

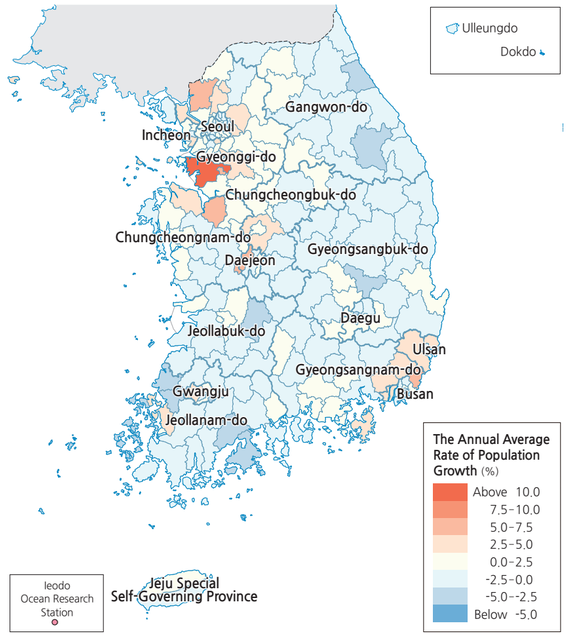
* Regional names and boundaries are based on the current administrative district.



2000–2005

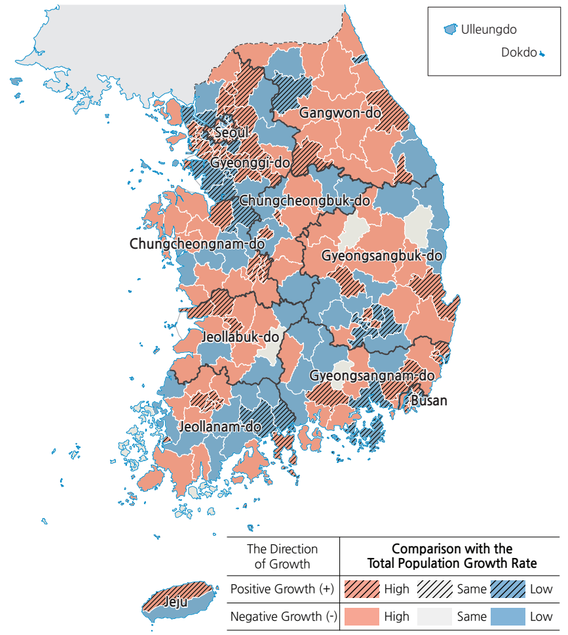


2005–2010

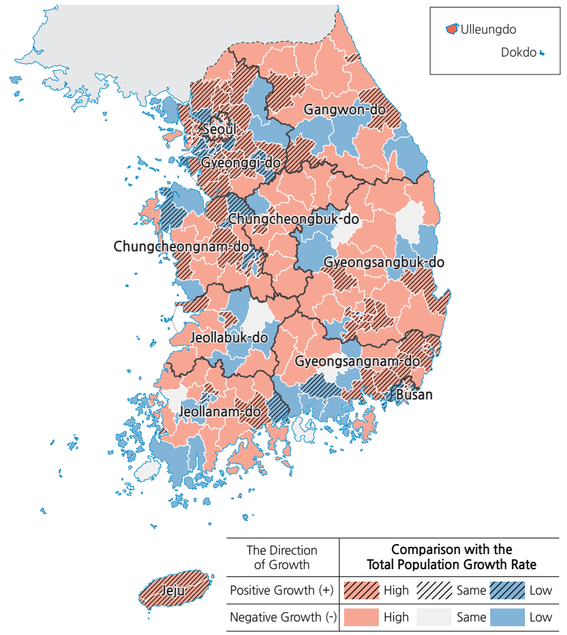


The National Population Growth Rate

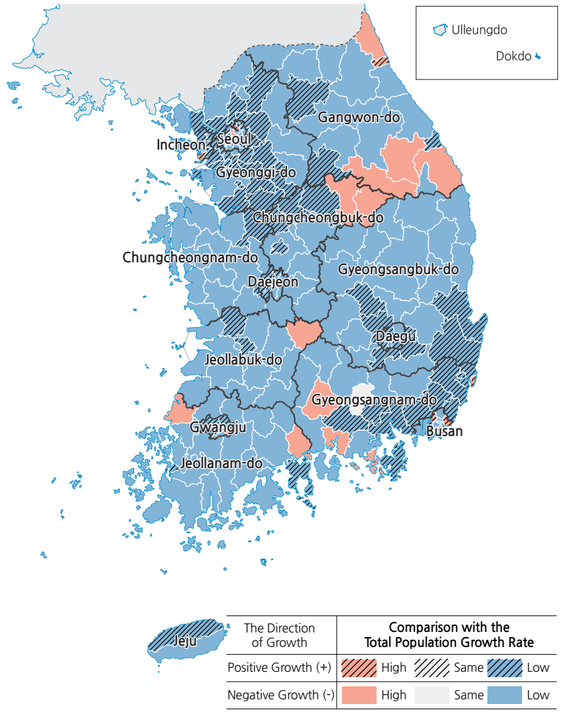
1980–1985



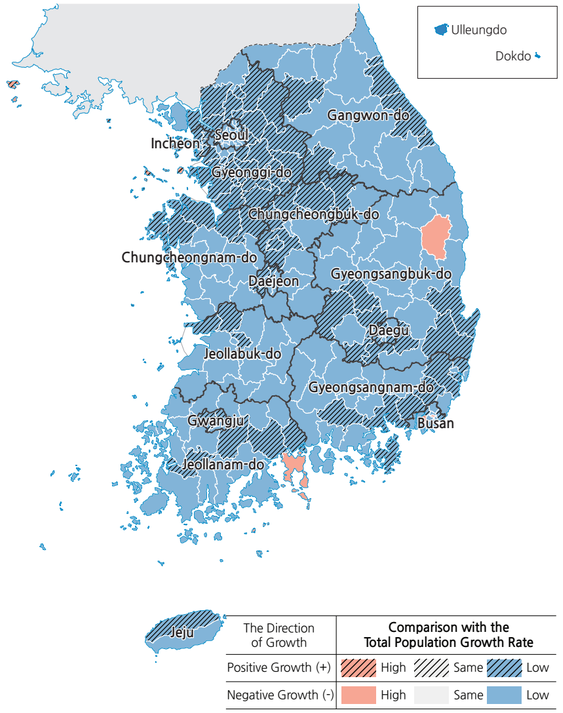
1985–1990



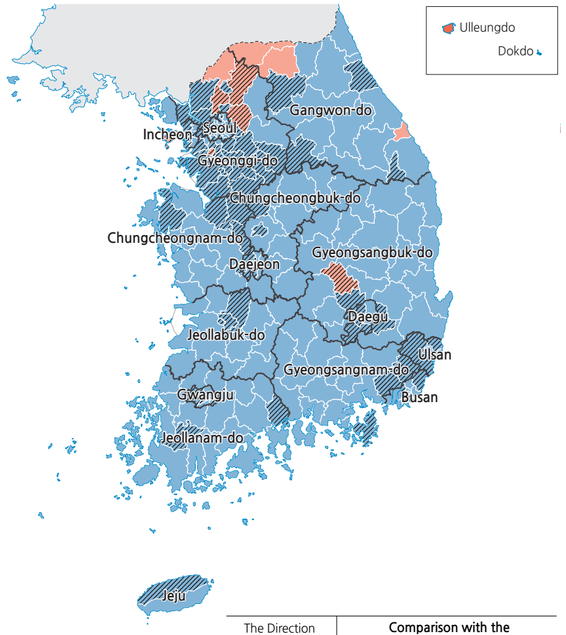
1990–1995



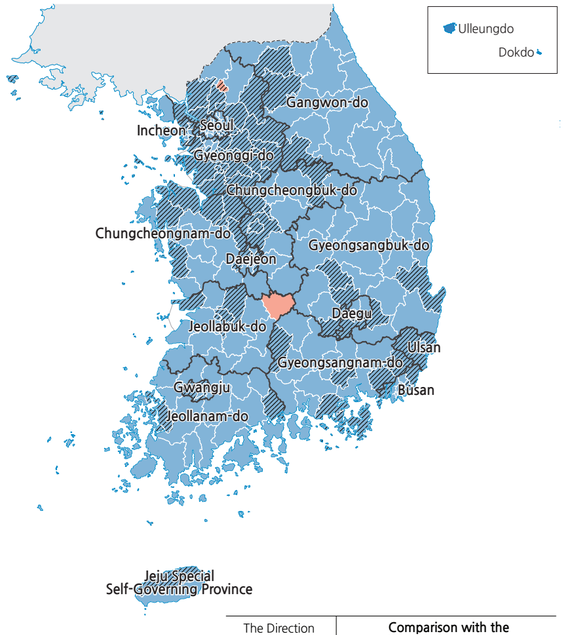
1995–2000



2000–2005



2005–2010



Statistics Korea (2023)

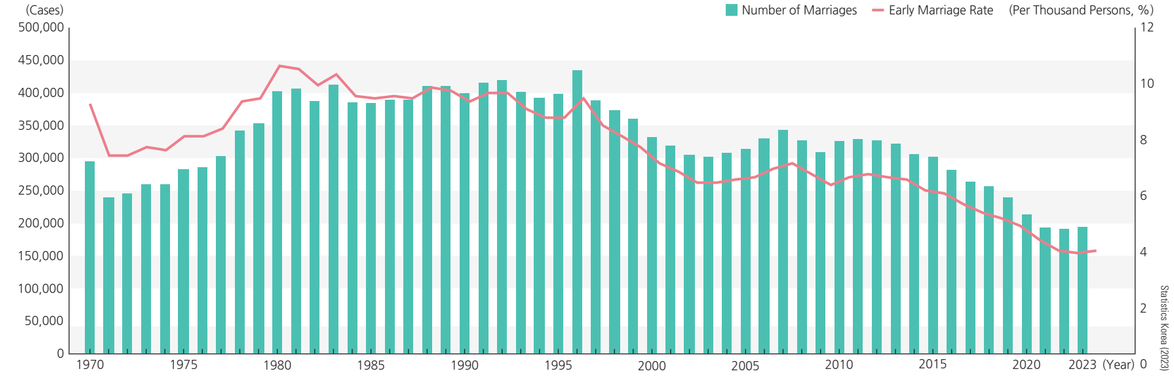
Current Status and Characteristics of Low Birth Rates and Aging Population

As of 2023, South Korea is experiencing an unprecedented ultra-low birth rate, with a total fertility rate of 0.72, ranking lowest among OECD countries and globally. Furthermore, the decline in the total fertility rate has occurred at a faster pace compared to other countries, making it the steepest globally.

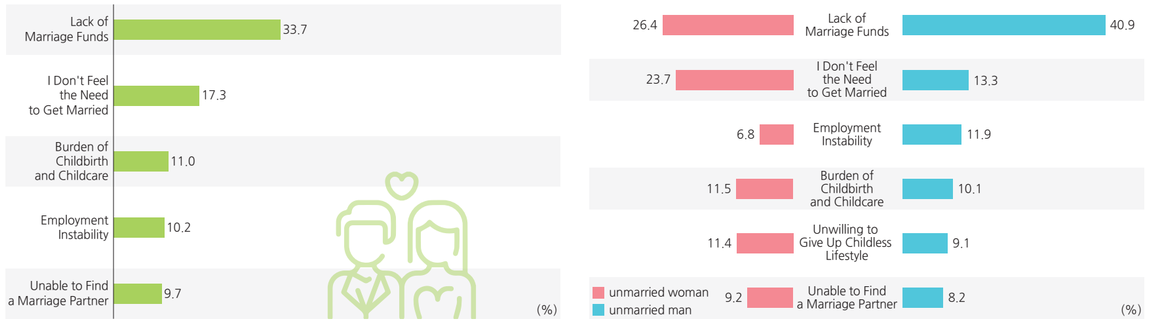
To analyze the causes of the low birth rate, government and private research institutions have used various standards and statistics. Three main statistical causes of the declining birth rate have been identified: 1) a decrease in marriage rates, 2) an increase in childless marriages, and 3) a decrease in the average number of children among married women with children.

South Korea's crude marriage rate (number of marriages per 1,000 people) has been steadily decreasing since 2012. The number of marriages dropped sharply from about 327,000 in 2012 to about 193,000 in 2023. According to the National Statistical Office's social survey, the main reasons for not getting married include economic burdens related to marriage, childbirth, and childcare, and employment instability, reflecting social and economic reasons.

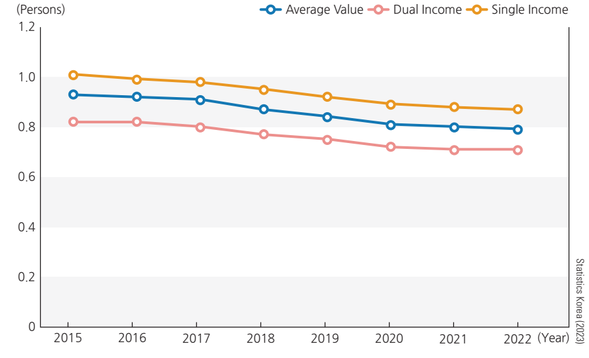
Number of Marriages and Early Marriage Rate



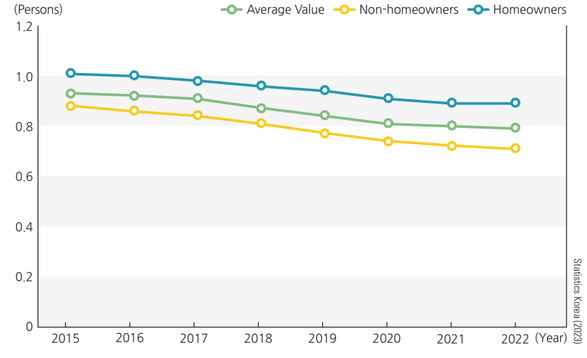
Main Reasons for Not Getting Married



Average Number of Births by Dual Income Status

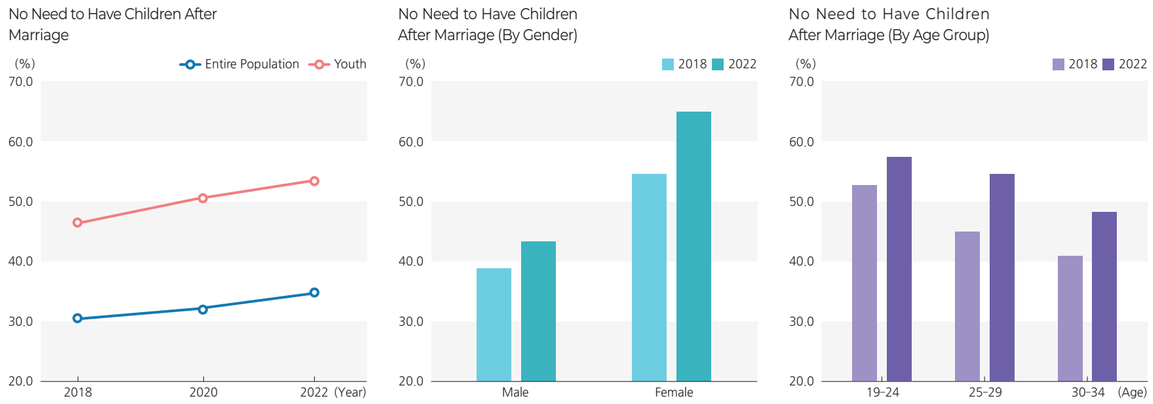


Average Number of Births by Home Ownership



Even among married couples, the rate of childlessness is increasing. In 2015, the average number of births per marriage within the first five years was 0.93, but this number dropped to 0.79 in 2022, showing a significant decline over about eight years. Economic conditions such as dual-income status and homeownership affect birth rates. Regionally, areas outside of the Seoul metropolitan area, such as Seoul and Gyeonggi Province, have higher average birth rates.

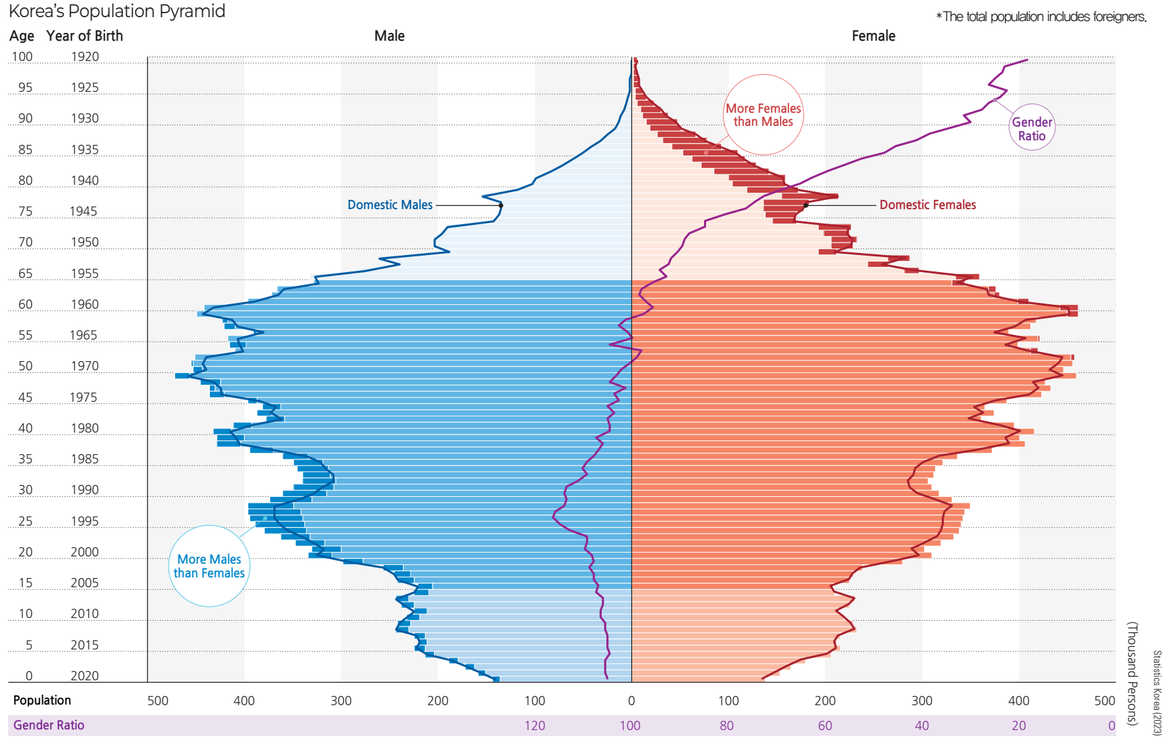
Children After Marriage



In a 2022 social perception survey by the National Statistical Office, more than half (53.5%) of young people responded that it is not necessary to have children after marriage, with women (65%) more likely than men (43.3%) to think that having children after marriage is not necessary. Also, younger age groups tend to have a more favorable perception of childlessness.

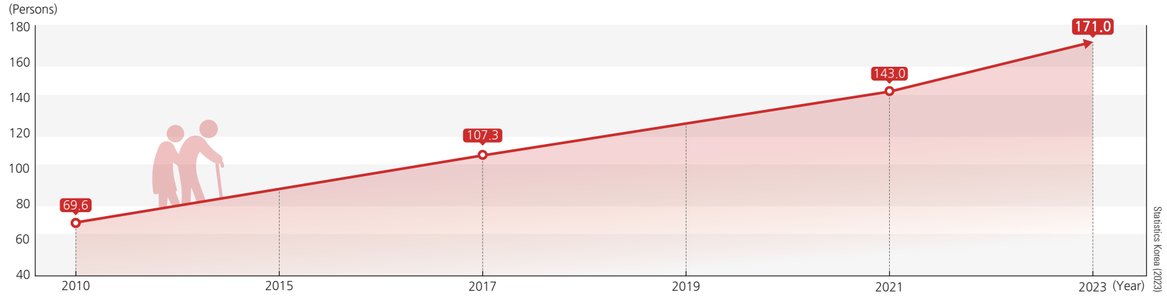
The persistent low birth rate has rapidly aged the population structure, resulting in South Korea having an extreme demographic structure characterized by ultra-low birth rates and a super-aged society. The population pyramid of South Korea in 2020 shows the middle-aged (35–49) and older middle-aged (50–64) groups made up about 56% of the total population. The median age of the total population, including foreigners, is 45.7, indicating a high level of aging in South Korea. Generally, a society is considered aged when the proportion of people aged 65 and over exceeds 14%, and older adults already comprise about 19.4% of South Korea's population, classifying it as an aged society. The proportion of infants (0–4 years) and children (5–14 years) combined is lower than that of the older adult population (about 2.5% and 9%, respectively). If the low birth rate and reluctance to marry continue to worsen, South Korea may eventually become a super-aged society with more than 20% of its population aged 65 and over. By gender, a male-dominant phenomenon is observed in the 0–59 age group, while a female-dominant trend is seen in the 60 and older age group.

Korea's Population Pyramid

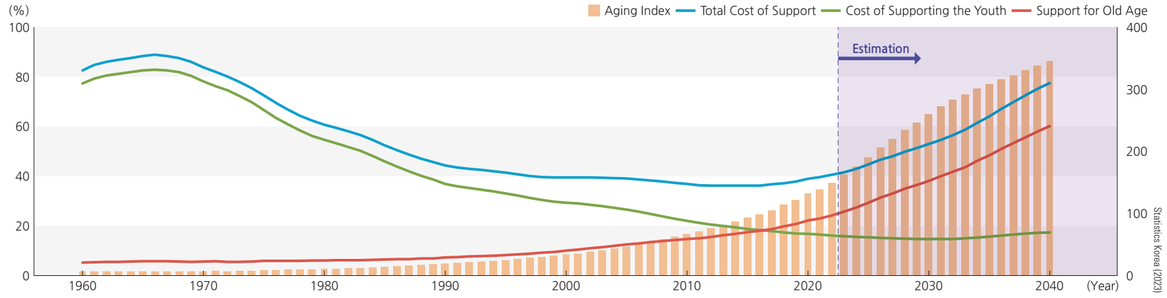


According to the "2023 Population and Housing Census Results," the aging index in 2023 was 171.0, up 14.9 from 2022 (1.71 older adults per youth in South Korea). The aging index exceeded 100 for the first time in 2016 (100.1) and has been increasing annually since 2018. The population aged 65 and over is approaching 10 million, with an increase of 462,000 from the previous year in 2023, reaching 9.609 million. The old-age dependency ratio (the number of people aged 65 and over per 100 working-age people) increased to 26.3. In contrast, the population aged 0–14 decreased by 241,000 (4.1%) to 5.619 million from the previous year. Due to the impact of population aging, the median age of the total population increased by 0.6 years to 45.7. The number of single older adult households reached 2.138 million, accounting for 9.7% of all households. The number of older adult households increased by 8.3% from the previous year, while the number of single older adult households increased by 7.2%. Single-person households accounted for 35.5% of all households, marking a record high due to aging and household diversification.

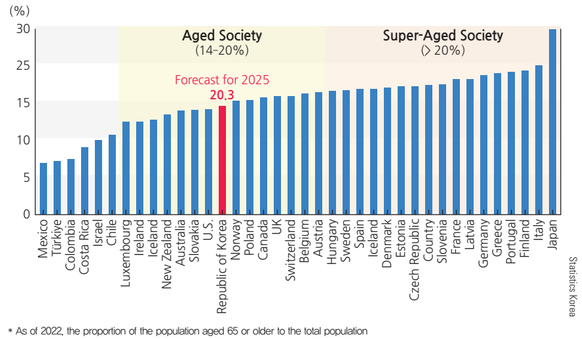
Aging Index Trend



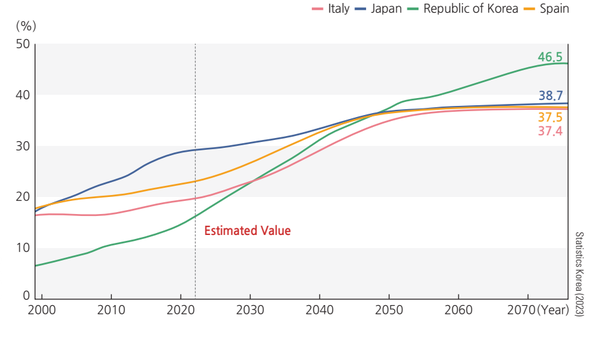
Cost of Support and Aging Index Outlook



Comparison of the Share of the Older Adult Population by Country



Forecasted Trend for the Older Adult Population Share



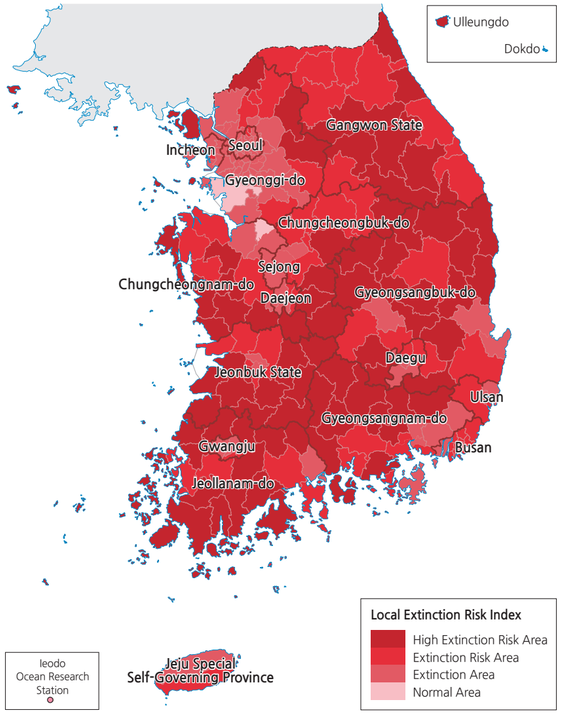
* As of 2022, the proportion of the population aged 65 or older to the total population

Such an abnormal demographic structure can lead to household income inequality arising from differences in the number of children or the age of children. The decline in the proportion of the working-age population and the increase in the old-age dependency ratio due to aging can hinder national growth in the long term. Additionally, the ongoing trend of low birth rates and aging increases South Korea's ranking in terms of the proportion of the older adult population compared to other OECD countries.

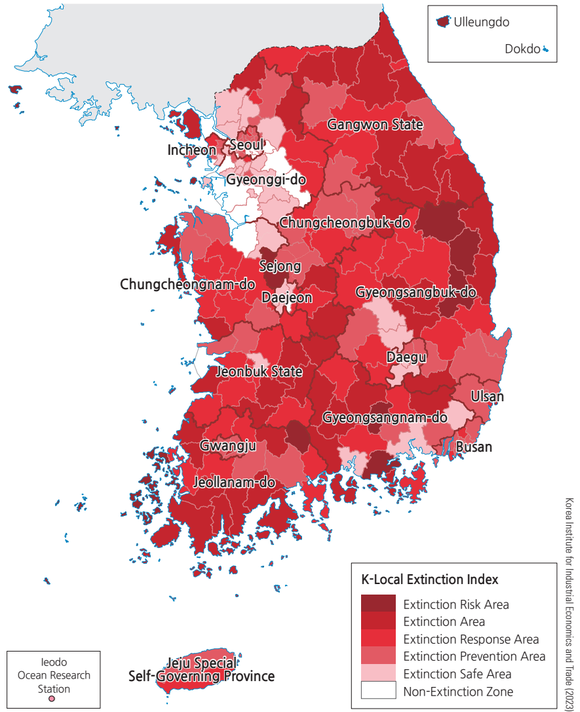
Furthermore, a decrease in the school-age population could lead to the collapse of educational infrastructure, and from a security perspective, a decline in conscription resources may make it challenging to maintain standing forces. In addition, the population crisis ultimately leads to the extinction of local areas, necessitating a national-level response. The government announced the establishment of the Population Strategy Planning Department in June 2024 to implement specific low birthrate measures and declared the world's lowest total fertility rate in 2023 a national emergency.

Concept and Indicators of Local Extinction

Local Extinction Risk Index (2023)



K-Local Extinction Index (2022)



Korea Institute for Industrial Economics and Trade (2023)

With the ongoing low birth rate and declining fertility rate, concerns about the extinction of regions are increasing. Recent research and surveys indicate that local extinction is accelerating due to the intensification of population outflow caused by social factors. In response, the government and academia have been using three indices—Masuda's Local Extinction Risk Index, the K-Local Extinction Index, and the Population Decline Region Index—to assess the extent of local extinction and devise appropriate countermeasures.

Masuda's Local Extinction Risk Index

Masuda's Local Extinction Risk Index, announced in Japan in 2014, measures the degree of local extinction based on the population of women of childbearing age and the older adult population (women aged 20–39/older adult population aged 65 or older). This index explains the risk level of regional extinction from a demographic perspective. The decline in the population of young women, who account for 95% of total births, leads to a decrease in population reproduction capacity, which results in a decrease in the total population. In other words, if the outflow of young women lowers the fertility rate and the number of older adult deaths within the region increases, the total population in a specific area will quickly decrease, leading to a stage of local extinction.

If the index value is between 0.5 and less than 1.0, the area is classified as a caution region for population extinction. If the value is between 0.2 and less than 0.5, it is classified as a risk region, and if it is less than 0.2, it is considered a high-risk region for population extinction.

K-Local Extinction Index

While Masuda's Local Extinction Risk Index focuses on natural factors of population reproduction capacity, in Korea, it is difficult to explain the phenomenon of local extinction solely through Masuda's logic due to the continuous outflow of the population caused by various social factors.

In 2022, the Korea Institute for Industrial Economics & Trade (KIET) developed the K-Local Extinction Index, which reflects the realities of the regional economy based on Korea's population and economic structure.

According to KIET, interregional population movements in Korea's local extinction areas are closely related to regional economic mechanisms such as income or jobs. The index is calculated based on four indicators: (1) innovation activities, (2) industrial structure advancement, (3) high-value-added enterprises, and (4) regional growth.

The indicator related to innovation activities uses per capita R&D expenditure, which is calculated based on the annual technology development expenditure spent in the region divided by the total population.

The indicator for checking the advancement of the industrial structure uses the All-Industry Diversity Index, which minimizes distortions that may be caused by the predominance of a specific industry in a particular region.

The indicator representing high-value-added enterprises uses the ratio of knowledge industries to total businesses, which is also used to prevent imbalances that may manifest when spatial deviations occur by industry and by region.

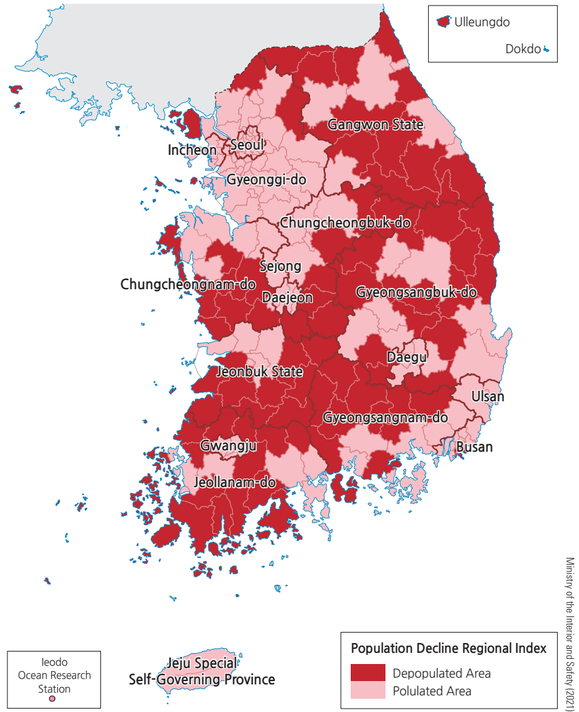
The last indicator of regional growth is not easily explained by a single indicator; therefore, three indicators—number of employees per 1,000 people, gross regional domestic product (GRDP) per capita, and population change rate—are used to comprehensively determine employment conditions, income, and population changes.

Population Decline Region Index

Population decline regions designated under Article 2 of the Special Act on Local Autonomy and Regional Balance Development are designated after deliberation by the Ministry of the Interior and Safety, related agencies, and the Regional Era Committee.

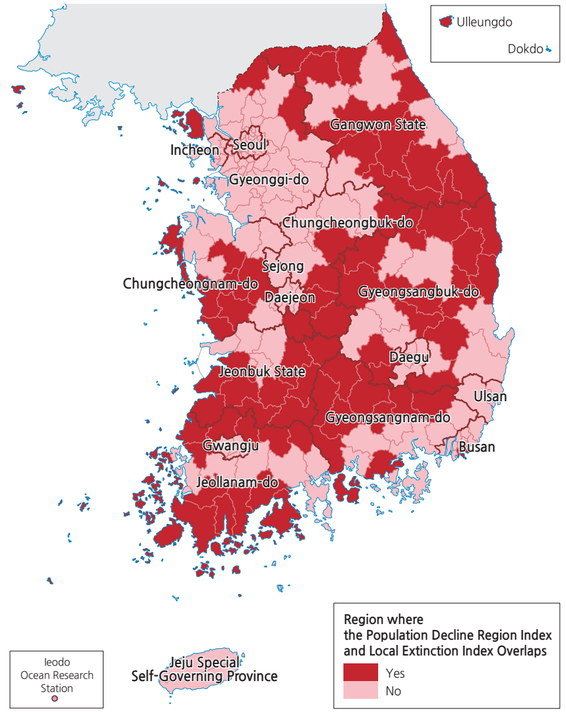
Local Extinction Risk Areas

Population Decline Region Index



Ministry of the Interior and Safety (2021)

Local Extinction Risk Areas



Population decline regions are selected based on a total of eight population decline index indicators: (1) annual average population growth rate, (2) population density, (3) net migration rate of young people, (4) daytime population, (5) aging ratio, (6) youth ratio, (7) crude birth rate, and (8) fiscal self-reliance rate.

According to Masuda's Local Extinction Risk Index evaluated in 2023, 157 out of 250 cities, counties, and districts were designated as local extinction risk areas. According to the K-Local Extinction Index in 2022, 116 areas were designated, and a total of 89 areas were designated as population decline regions according to the Population Decline Region Index in 2021. Among these, 84 places were designated as risk areas by all three indices.

Local Extinction Risk Areas

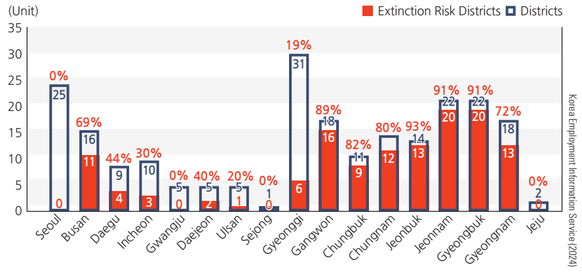
Based on population data, there were no local extinction risk or high-risk areas in 1980 and 1990, but the number of these areas increased sharply between 2000 and 2020. During the same period, the number of risk areas increased by about 2.4 times (29 in 2000 to 70 in 2020), and high-risk areas increased by 1.4 times between 2010 and 2020 (27 in 2010 to 38 in 2020). Based on the 2023 population, there are currently 78 risk areas and 79 high-risk areas, indicating a further increase in the risk of local population extinction.

According to Masuda's Local Extinction Risk Index calculated based on 2023 population data, a total of 18 municipalities in non-metropolitan or metropolitan cities were not classified as risk or high-risk areas nationwide, including Heungdeok-gu and Cheongwon-gu in Cheongju, Dongnam-gu and Seobuk-gu in Cheonan, Asan City, Gyeryong City, Wansan-gu and Deokjin-gu in Jeonju, Gwangyang City, Nam-gu and Buk-gu in Pohang, Gumi City, Gimhae City, Geoje City, Yangsan City, Uichang-gu and Seongsan-gu in Changwon, and Jeju City. These results indicate that the risk of local extinction is relatively rapidly increasing in areas outside the metropolitan area. Similar results can be seen in the map results of the Population Decline Region Index and the K-Local Extinction Index.

As of 2024, there are no residents in Jinsa-myeon in Paju, Gyeonggi Province; Geundong-myeon, Wondong-myeon, Wonnam-myeon, and Imnam-myeon in Cheorwon County, Gangwon Province; and Sudong-myeon in Goseong County, Gangwon Province. These areas, adjacent to the civilian control line, currently have no registered residents. In addition, even in Busan, Daegu, Gwangju, Daejeon, Ulsan, and Incheon, and Seoul, administrative districts that have entered the extinction risk phase exist, indicating that the risk of local extinction has started nationwide, including urban areas.

In areas with a high risk of extinction, birth rates are very low, and death rates are high. Since 2005, the government has diagnosed the natural decline of the population as the main cause of local extinction and has been promoting measures to respond to low birth rates. However, recent analysis of population increase and decrease factors indicates that the main cause of local extinction is population outflow due to social factors rather than natural decline, pointing out the limitations of existing population and social policies.

Risk of Regional Extinction Continues to Rise



Korea Employment Information Service (2024)

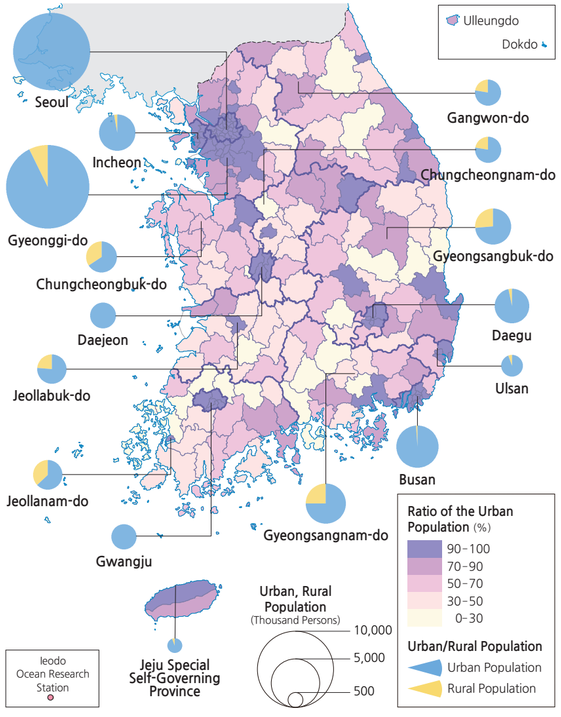
Characteristics of Local Extinction Risk Areas

By looking at the areas where the three indices overlap in measuring local extinction, it is possible to find that risk areas are mainly distributed in rural areas. This can be inferred from the larger population of urban areas compared to rural areas, and it serves as an indicator that social mobility to cities is continuously active.

The urban population increased sharply until the early 1990s, and according to data from the Ministry of Land, Infrastructure and Transport and the Korea Land and Geospatial Informatix Corporation in 2022, the urban population ratio in Korea is about 92%, higher than the world average of 57%. In Korea, urban areas are classified based on administrative districts (dong/eup areas) and zoning areas (urban areas in zoning areas), and there is little difference between the urban populations calculated based on each standard.

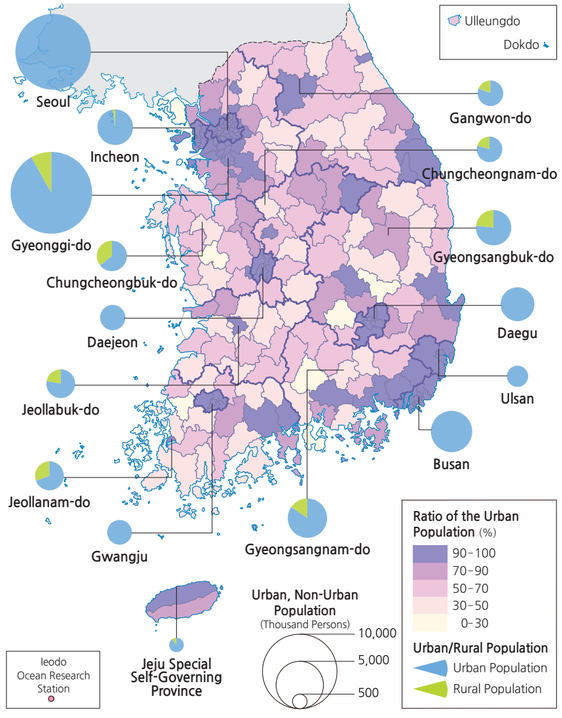
Urban Population by Administrative District

2010



Urban Population by Zoning Area

2010

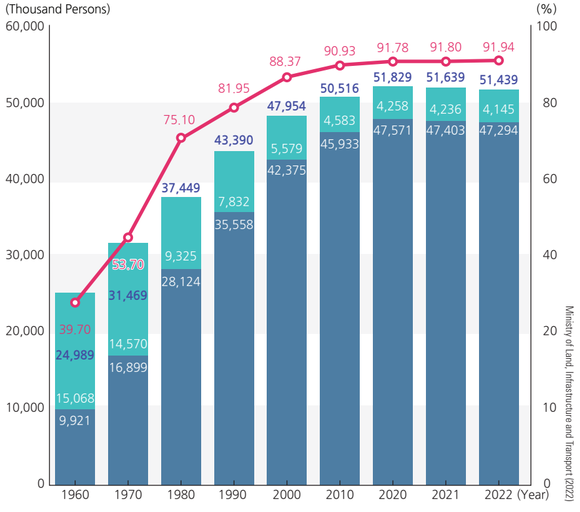


Zoning area-based cities are widely distributed in metropolitan areas, where the urban population ratio is high. Looking at administrative districts, the proportion of myeon (rural areas) has decreased, while the proportion of dong/eup (urban areas) has increased. In particular, the composition ratio of dong/eup in the metropolitan area has continued to increase, reaching about 50% of the total in 2005, and is still higher than in other regions. As of 2024, the population concentration in the metropolitan area, where more than 50% of Korea's total population lives, has intensified, and most of the population in that area lives in cities. This can also be found in the maps of urban population and urban area distribution by province and city/county/district in 2010 and 2020. The per capita urban area ratio is higher in areas with smaller populations than in large cities.

Even in areas that are not rural, the extinction risk area may develop into a social problem. Extinction risk is spreading extensively to large cities and old downtown areas with populations of more than 500,000. For example, despite being a metropolitan area, about 43.8% of Busan's districts are at risk of extinction.

The increase in extinction risk areas can cause various social problems, such as increasing the burden of supporting older adults due to aging. Therefore, the government is making various policy responses and institutional efforts to improve social awareness.

2022 Urban Planning Statistics



Policy Responses to Local Extinction

Past policies to counter local extinction focused on ways to slow the population decline and improve the living conditions in extinction risk areas through economic and social means. However, the government's current policy response has shifted to the establishment of a comprehensive response system considering various aspects of the problem.

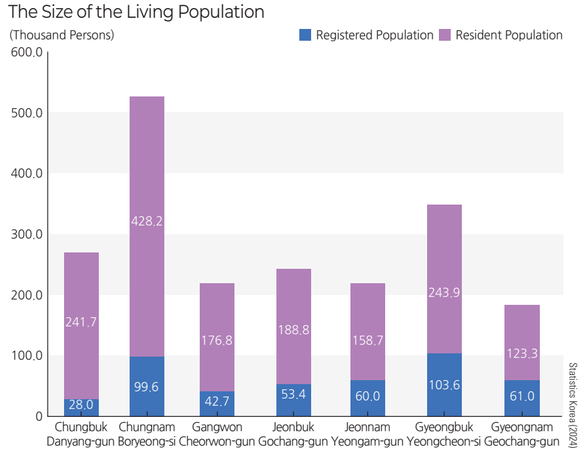
The government's policy response to local extinction risk areas focuses on improving policies to counter population decline, creating an environment where young people want to stay, enhancing the quality of life for residents in the areas, and implementing institutional policies for sustainable urban development. Specific policies include measures to support childcare and education, support for cultural and recreational activities, measures to revitalize the local economy through job creation, and policy support to create an environment where residents want to stay.

The regional extinction response model currently being considered is a mixed population model based on population composition, local economy, and social conditions. This model attempts to stabilize the population through various policy means, such as regional economic policies, local economic support, and local development promotion, to create a population composition suitable for local circumstances. In addition, various models are being considered to address social problems related to local extinction, such as establishing living infrastructure and providing social services to improve the quality of life for residents.

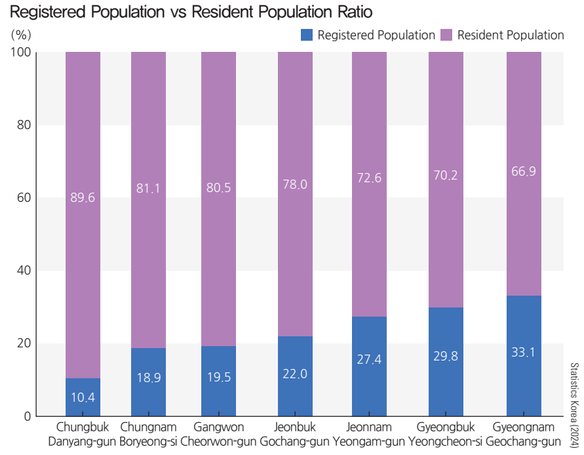
In particular, it has been pointed out that policy efforts to improve public perception are also important. The government plans to promote a campaign to improve public awareness so that all citizens may be interested in and engage with the issue of local extinction, and plans to consider a policy response that emphasizes public participation.

In addition, academic efforts are being made to predict local extinction based on various data and to present new models to explain local extinction. Based on this, government institutions, academia, and research institutions are proposing more scientific and reasonable policy measures and response strategies and are actively working to prevent the acceleration of local extinction.

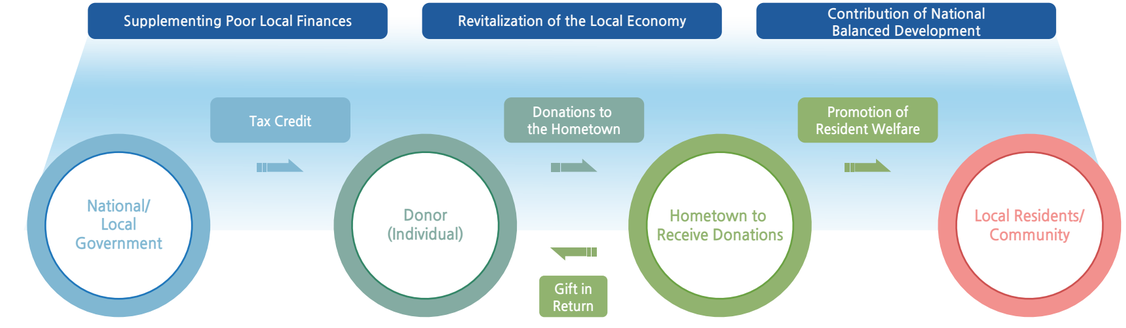
The Size of the Living Population



Registered Population vs Resident Population Ratio



Donation to the Hometown



Research and exploration of polar regions and oceans are processes that expand Korea's scientific and resource territory beyond its national borders, into the common areas of the Earth shared by humanity. Beyond mere competition for territory and resources among nations, these endeavors represent international cooperation in responding to global climate change and environmental changes, utilizing Korea's research and technological capabilities.

Korea's polar research and exploration began in earnest after joining the Antarctic Treaty in November 1986, with the construction of the Antarctic King Sejong Station, a permanent scientific base, in 1988. At the King Sejong Station, about 18 overwintering researchers stay throughout the year, while approximately 100 summer researchers are dispatched from December to February, the Antarctic summer, to conduct various studies.

Since the construction of the King Sejong Station, Korea has carried out various research and exploration activities centered around the station. In 2014, Korea expanded its research and exploration to a broader area closer to the Antarctic continent with the construction of the Jang Bogo Antarctic Research Station. Since 2009, Korea has been building geographical information by conducting surveys and mapping around the station. A total of 27 unique Antarctic place names (17 in 2011 and 10 in 2012) were registered in the Composite Gazetteer of Antarctica (CGA).

Research and exploration in the Arctic have been actively conducted since the establishment of the Dasan Arctic Research Station in 2002. In 2012, Korea obtained permanent observer status in the Arctic Council, providing opportunities for direct participation in the Arctic route and resource development. The Dasan Arctic Research Station, the 12th Arctic science station in the world, operates as a non-permanent base, visited by about 60 domestic and international researchers each summer (June to September).

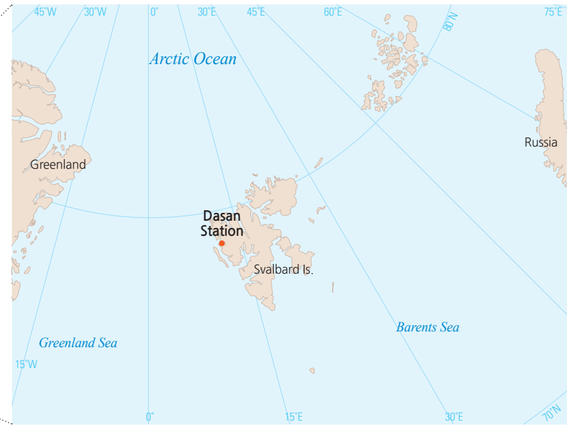
In 2009, Korea constructed its first icebreaker for polar research, the Araon, which began navigating independently in the icy waters of the Arctic and Antarctic. The Araon carries out polar research, creates new routes, and supplies the Antarctic and Arctic scientific stations. Utilizing seabed topography data collected by the Araon, Korea registered two Korean seabed names, Dolphin Hill Group and Ggotshin Noll, with the International Hydrographic Organization (IHO) in 2013, and in 2014, produced and published a provisional nautical chart for the waters around the Jang Bogo Antarctic Research Station.

Korean Research Icebreaker, Araon

Korea's Polar Science Bases

Dasan Arctic Research Station

Detailed Map of Dasan Arctic Research Station



Antarctic Voyage of Araon

Arctic Voyage of Araon

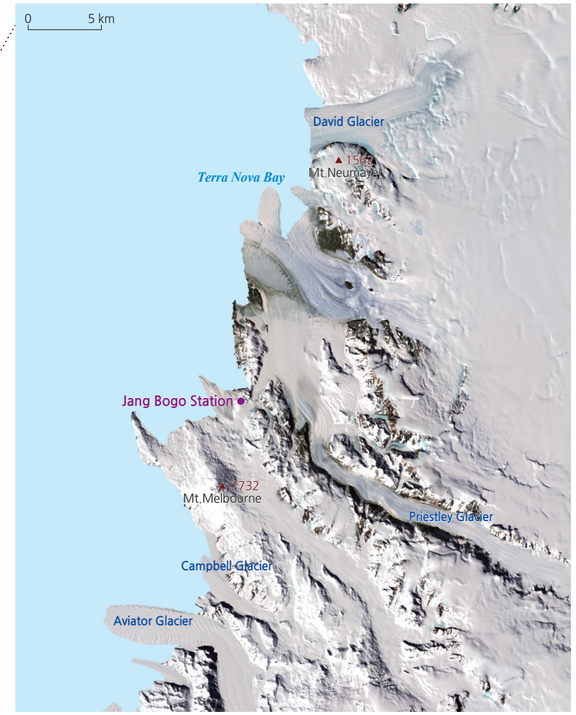

Dasan Arctic Research Station


Dasan Arctic Research Station in Ny-Alesund Village

King Sejong Antarctic Research Station

Antarctic Research Stations

Jang Bogo Antarctic Research Station



King Sejong Antarctic Research Station

Jang Bogo Antarctic Research Station

Korea's Marine Science Bases

Research on the seas surrounding Korea holds significant importance related to Korea's territory. Korea has established a national ocean observation network, consisting of tidal observation stations, marine observation stations, marine observation buoys, seawater flow observation stations, and comprehensive marine science bases. This network collects, analyzes, and discloses various observational data, such as tides, water temperature, waves, currents, and marine weather. These data are useful for coastal environmental protection and marine safety operations.

Ieodo Ocean Research Station

Ieodo Ocean Research Station

The Ieodo Ocean Research Station symbolizes Korea's interest in the Ieodo waters. The station was built by the Korea Ocean Research Institute with an investment of KRW 21.2 billion from 1995 to June 11, 2003. It provides real-time marine and weather information and typhoon forecasts and conducts scientific research on climate change and marine environmental characteristics in the Northwest Pacific region. The total area of the Ieodo Ocean Research Station is 1,320 km², with a height of 36 m above sea level and a total height of 76 m from the underwater rock. It is located 149 km southwest of Marado, Korea, 276 km west of Torishima, Japan, and 287 km northeast of Seshan Island, China, at latitude 32°07' N, longitude 125°10' E.

The Ieodo Ocean Research Station was established to perform comprehensive ocean observations, collecting marine, meteorological, and environmental data. Positioned along a path through which over 60% of the typhoons affecting the Korean Peninsula pass, it plays a vital role in typhoon observation, research, and forecasting, and serves as a lighthouse for safe navigation and a forward base for marine rescue operations. Additionally, the Korea Ocean Research Institute employees inspect observation equipment at the station. The station is equipped with 13 advanced meteorological observation devices, 20 marine observation devices, six environmental observation devices, and four structural stability measuring devices. The data collected are transmitted in real-time via the Mugunghwa satellite to the Korea Ocean Research Institute and the Korea Meteorological Administration.

Sinan Gageocho Ocean Research Station

The Sinan Gageocho Ocean Research Station was completed on October 13, 2009, with a total area of 286 m², a height of 31 m above sea level, and a total height of 46 m from the underwater rock. Located 47 km west of Gageo Island, at latitude 33°56' N, longitude 124°35' E, the station is positioned in the southern West Sea. The West Sea is significant because various marine phenomena, weather phenomena, and atmospheric constituents travel into Korea due to the westerly winds. This station significantly contributes to understanding the effects of fine dust, a major environmental issue in Korea.

The Sinan Gageocho Ocean Research Station provides real-time meteorological and marine information on the internet to support related marine industries such as fishing, maritime traffic, and marine leisure, and also helps reduce damage caused by disasters by improving the accuracy of marine and weather forecasts.

Sinan Gageocho Ocean Research Station

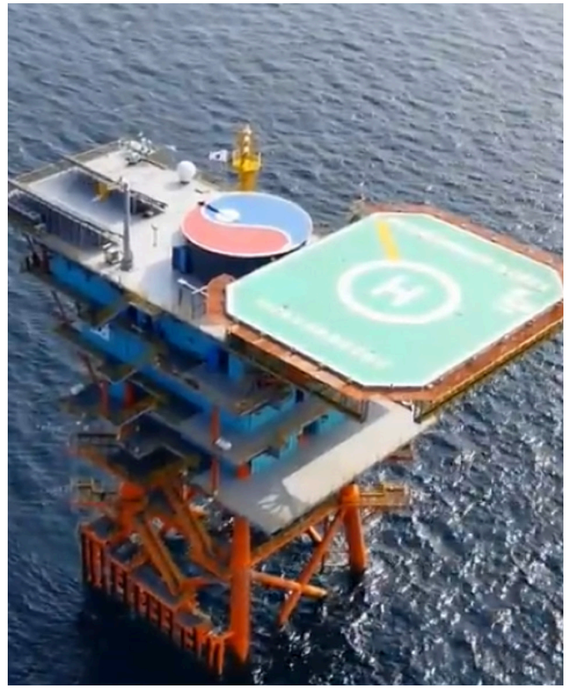
Ongjin Socheongcho Ocean Research Station

The Ongjin Socheongcho Ocean Research Station was constructed under the name Socheongcho Ocean Research Station by the Korea Institute of Ocean Science and Technology between 2011 and 2014, with its operation commencing on January 1, 2016, after a trial run from 2014 to 2015.

Like the Sinan Gageocho Ocean Research Station, the Ongjin Socheongcho Ocean Research Station was established to enhance the accuracy of weather and marine forecasts for the West Sea and protect the marine environment, reflecting the increasing importance of the West Sea's marine environment and weather information. The station provides atmospheric environmental information, including data on yellow dust, fine dust, ozone, and environmental radioactivity, and monitors the formation and annual changes of West Sea bottom cold water and global ocean environmental changes.

Currently, the Ongjin Socheongcho Ocean Research Station, operated by the National Oceanographic Research Institute, covers an area of 2,700 m², with a total height of 90 m from the underwater rock. The station is located 37 km south of Socheong Island, at the coordinates 37°25' N, 124°44' E.

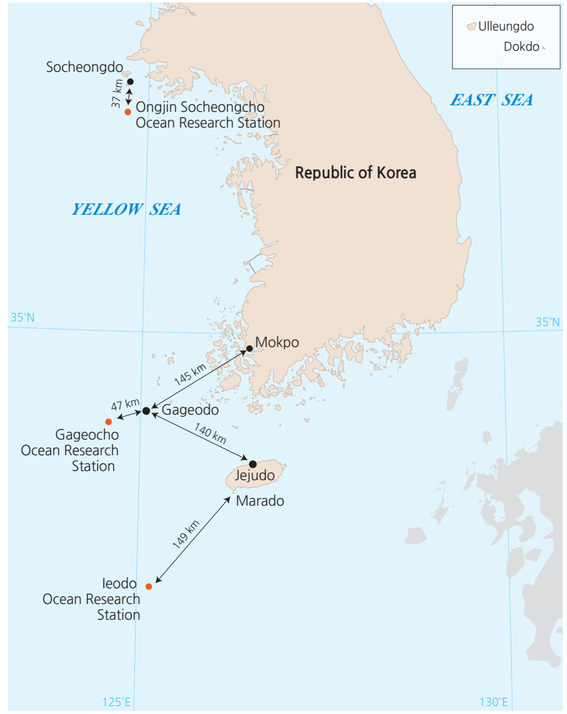
National Ocean Observation Network



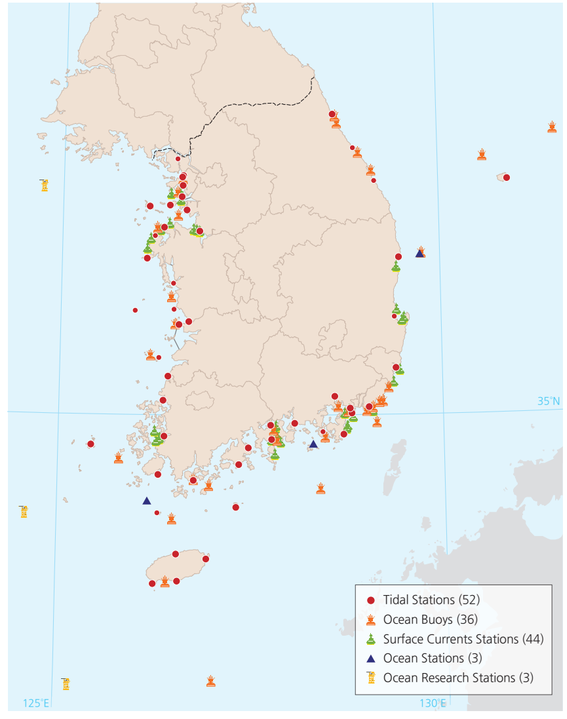
Ongjin Socheongcho Ocean Research Station

The National Ocean Observation Network is an observation network operated to effectively manage Korea's jurisdictional waters. It consists of tidal observation stations, marine observation stations, marine observation buoys, seawater flow observation stations, and comprehensive marine science bases. The data observed through the National Ocean Observation Network include tide, water temperature, salinity, wind direction, wind speed, current direction, current speed, and wave height. Collecting and analyzing marine observation data through the National Ocean Observation Network contributes to enhancing national capabilities related to the use, development, conservation, climate change, and marine disasters of Korea's jurisdictional waters. Additionally, the establishment and operation of such a national ocean observation network carry significance for building marine surveillance infrastructure necessary for strengthening marine defense capabilities. The data collected through the National Ocean Observation Network is publicly available on the internet through the Korea Ocean Observing and Forecasting System (KOOFS). The analyzed results of the observation data are provided to approximately 200 related institutions in newsletters, annual white papers, and special phenomenon reports.

Ocean Research Station



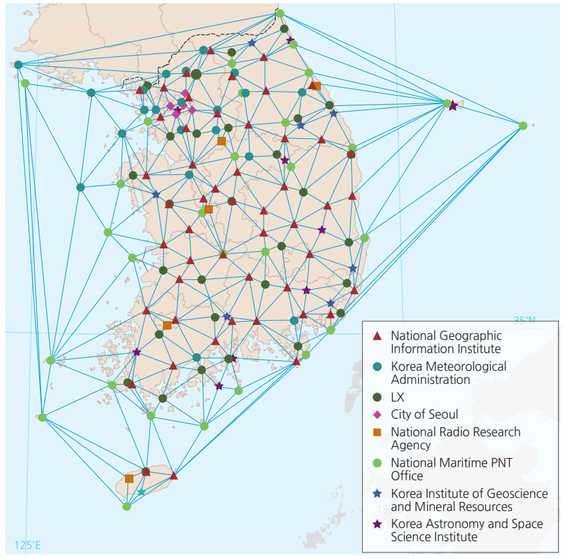
Ocean Research Observation Network

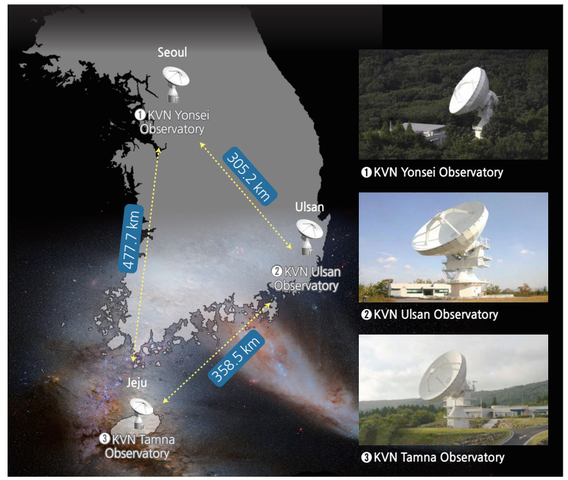


Research in the Field of Geodesy

The Global Navigation Satellite System (GNSS), used in navigation, surveying, and geodesy, is a system that provides information on the position, altitude, and velocity of ground objects using artificial satellites. The system is operated at 165 GNSS observation stations by eight institutions, including the National Geographic Information Institute, the Ministry of Oceans and Fisheries, the Korea Meteorological Administration, Korea Land and Geospatial Informatix Corporation, the Korea Astronomy and Space Science Institute, and the Korea Institute of Geoscience and Mineral Resources. Very Long Baseline Interferometry (VLBI), a technology that measures the precise location of ground reference points and the movement of the Earth in space, is being operated with an astronomy research VLBI (Seoul, Ulsan, Jeju) and a geodesy-dedicated VLBI (Sejong).

Permanent GNSS Stations





VLBI Network

VLBI Observatory

Since the 1990s, research and development in the field of space have been actively conducted, leading to the launch of seven scientific and technology satellites, five multipurpose practical satellites for Earth observation, and three geostationary orbit satellites. Additionally, to secure satellite launch operation technology, three scientific rockets were launched, and in 2009, the Naro Space Center was established on Naro Island in Goheung County, South Jeolla Province. In 2013, KSLV-1 (Naro), which carried a 100 kg-class small satellite, was launched. In 2018, the test launch of an engine for developing the Korean launch vehicle Nuri was successful. In 2021, KSLV-2 (Nuri), carrying a 1,500 kg-class practical satellite, was launched, and with the consecutive successes of the second and third Nuri launches in 2022 and 2023, South Korea became the seventh country capable of placing a satellite weighing over 1 ton into orbit, following the United States, Russia, China, Japan, France (EU), and India.

Additionally, the government has been fostering the space industry through the creation of the Southern Coast Space Industry Cluster and has been leading institutional support through the establishment of the Space Aviation Agency (inaugurated May 27, 2024), which is responsible for space and aviation industries.

The Space Industry Cluster is a growth hub for nurturing a privately-led space industry. In December 2022, the government designated Gyeongnam as a satellite-specialized zone, Jeonnam as a launch vehicle-specialized zone, and Daejeon as a research and talent development-specialized zone through the National Space Committee. In Jinju, the Space Environment Test Facility, which will be the core infrastructure of the satellite-specialized zone, is planned to be built.

Jeollanam-do, the launch vehicle-specialized zone, is home to Korea's only Naro Space Center and is considered the best region for expanding private launch sites. It has the optimal conditions for supporting the launch vehicle industry. To drive the private launch vehicle industry, various plans are being established and pursued, such as specialized industrial complexes, private launch sites, and the construction of a launch vehicle technology commercialization center.

Gyeongsangnam-do, the satellite-specialized zone, has a system integrator company that serves as a hub for the satellite industry, with numerous related companies concentrated in the area and possessing excellent manufacturing innovation capabilities. The government has also announced plans to expand infrastructure, such as a Satellite Manufacturing Innovation Center, to support timely satellite development.

Lastly, Daejeon Metropolitan City, the research and talent development-specialized zone, is a well-known city of science and research, with key research institutions, educational institutions, and companies related to the space sector densely clustered, possessing the nation's top level of research and development expertise and infrastructure.

Research on Korea's Space Industry

Sustainable Development Goals (SDGs) and South Korea

In 2015, the UN adopted the Sustainable Development Goals (SDGs) to address global economic, social, and environmental issues in an integrated manner. This framework outlines common goals for humanity to achieve by 2030 to enhance the quality of life for both current and future generations. Likewise, various natural disasters and abnormal weather patterns around the world have made the international community aware of the seriousness of rapid climate change. As a result, the Paris Agreement was adopted in 2015, marking the launch of a new climate regime involving both developed and developing countries. This regime aims to limit the global temperature increase to within 1.5 degrees Celsius, implementing worldwide response measures to achieve this.

In South Korea, despite its outwardly high economic growth, contradictions persist, such as income inequality, environmental degradation like fine dust, and a lack of quality jobs, which have not substantially improved the quality of life for its citizens. Against this backdrop, the government selected the enhancement of sustainable development as a national agenda in 2018 and established the Korea Sustainable Development Goals (K-SDGs) to complement the Third Basic Plan for Sustainable Development.

The K-SDGs encompass universal values and goals that the international community aims to achieve by 2030. They consist of 17 areas, 122 detailed goals, and 214 indicators. To establish a development direction suitable for South Korea's situation, 122 new indicators, not included in the UN-SDGs, were added to the total indicators, accounting for 57% of the whole, balancing global and nation-specific indicators.

Additionally, the process of establishing the K-SDGs employed a bottom-up approach involving participation from government-related departments, private stakeholders, and the general public, unlike the top-down decision-making methods commonly seen in previous policies.

Introduction of Renewable Energy and Environmental, Social, and Governance (ESG) Performance Indicators

Division	Korea Sustainable Development Goals (K-SDGs)	K-ESG Guidelines
Outline	· It is a system comprised of 17 goals, 199 detailed goals, and 236 indicators meant to support the achievement of the UN SDGs common goals for the international community by 2030, and to solve problems in Korean society. (2018.12.)	· It is a guideline prepared jointly by related ministries centered on the Ministry of Strategy and Finance and summarizes management elements and evaluation items to be considered first. By organizing common and key matters, we support the use of ESG management information by companies, small and medium-sized enterprises, and evaluation and verification agencies. (Announced in December 2021.)
Characteristic	· Universal validity and inclusiveness reflecting Korean reality are important; implementation and management obligations of the National Sustainability Committee and related ministries, etc.	· Social norms for disclosure and implementation based on investment criteria, etc. are in progress, moving beyond the level of voluntary report disclosure centered on large corporations. (Various assessments and guidelines are presented simultaneously.)
Stakeholders	· K-MGOs major stakeholder groups (people with disabilities, women/family, youth, teenagers, workers, farmers, immigrants, animal protection, industry, science and technology, education/academics, NGOs, local communities, local governments).	· Business partners, civil society organizations, consumers, customers, employees and other workers, governments, communities, non-governmental organizations, shareholders and other investors, suppliers, labor unions, vulnerable groups, etc.
Composition	· 5 principles: people, planet, prosperity, peace, partnership. · Goal (17) is applied uniformly worldwide. · Detailed goals: Indicators maintain consistency while reflecting regional specialties.	· Five Principles of Ethical Investment: There are various guidelines for linking GRI and SDGs. · In particular, it is divided into the aspect of "evaluating activities" that fulfill the company's sustainability management responsibilities and the aspect of "disclosing related information" such as activities and evaluation results.

One of the various responses to sustainable development and climate change is the energy transition, which emphasizes replacing the fossil fuel-based energy system with the distribution of renewable energy. Policies toward carbon neutrality in various countries include the decarbonization of the transition sector through an increased share of renewable energy.

South Korea is also actively promoting the distribution of renewable energy through Goal 7 of the K-SDGs, titled "Environmentally Friendly Production and Consumption of Energy." Ahead of the Paris Agreement in 2015, the South Korean government announced a commitment to a 37% reduction in greenhouse gas emissions compared to the business-as-usual (BAU) level by 2030. Following the inauguration of the Moon Jae-in Administration in 2017, the government announced that it would reduce emissions by about 24.4% by 2030 compared to 2017, applying the reduction standards of developed countries.

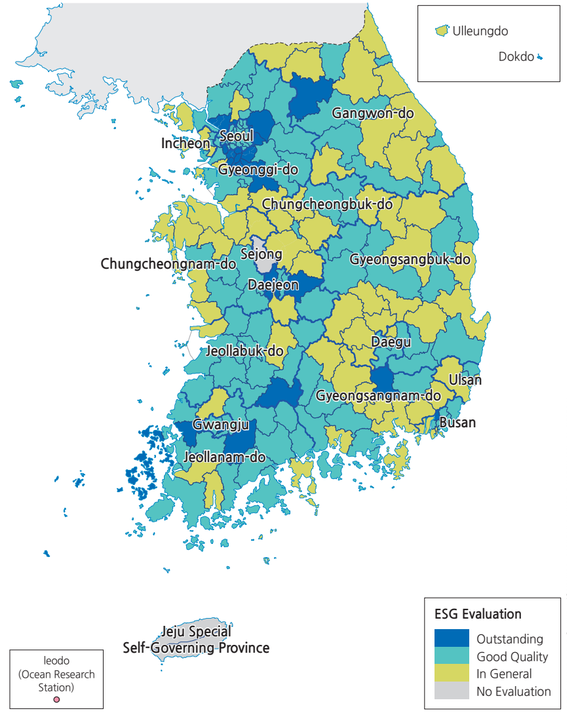
Following the Paris Agreement, the UN implemented an emissions trading system, where countries are assigned specific greenhouse gas emissions limits. If a country exceeds its limit, it can purchase emission rights from other countries; if it emits less, it can sell its emission rights. Moreover, to promote environmental contributions from private companies, ESG performance indicators are being actively utilized in management evaluations, thereby increasing corporate social responsibility and encouraging proactive responses to environmental and climate change issues.

Interest in and evaluation of ESG management are being conducted not only for companies but also for local governments. In 2023, the government assessed the ESG suitability of local governments' administration and policies and their regional sustainability by measuring and evaluating the performance and capacity of local governments concerning the basic principles and responsibilities outlined in the Framework Act on Sustainable Development.

Additionally, ESG management has emerged as a campaign in the form of RE100, which stands for Renewable Energy 100%. This campaign aims for companies to source 100% of their electricity from renewable energy sources, such as wind or solar power, by 2050. To achieve RE100, companies are adopting renewable energy in various ways, such as directly building facilities like solar power plants or purchasing electricity from renewable energy power plants.

In South Korea, the Korean-style RE100 (K-RE100) system was introduced in 2021, allowing electricity consumers in South Korea to purchase or use renewable energy regardless of their annual electricity consumption by registering with the Korea Energy Agency. To actively promote this, various implementation measures have been launched and support provided for recognizing performance since 2021, allowing companies and public institutions to purchase renewable energy electricity. Additionally, efforts to practically implement RE100 are underway through amendments to the Electricity Business Act and its Enforcement Decree (October 2021) to enable direct Power Purchase Agreements (PPAs) between renewable energy operators and electricity consumers. As a result, the capacity for renewable energy participation in the electricity market has steadily increased from 2019 to 2023.

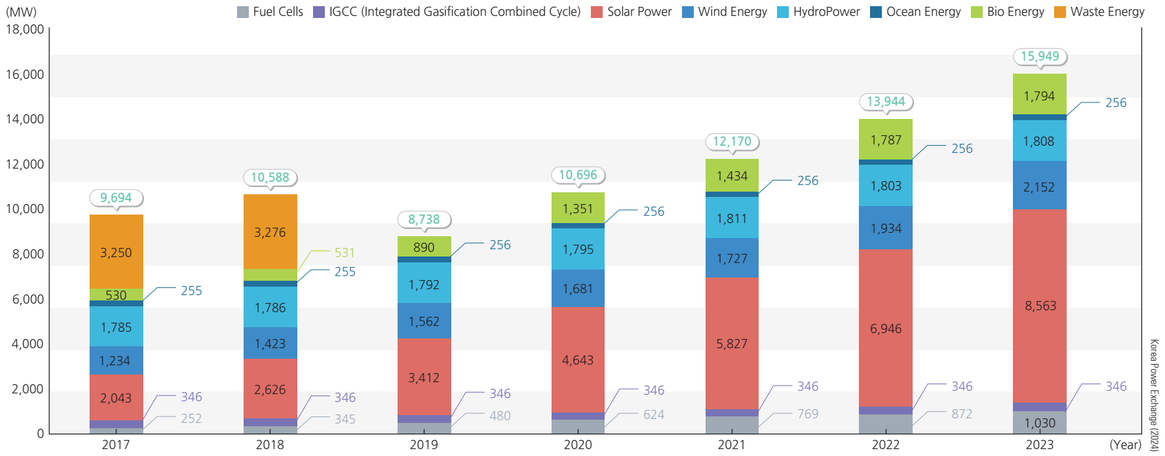
ESG Management Evaluation



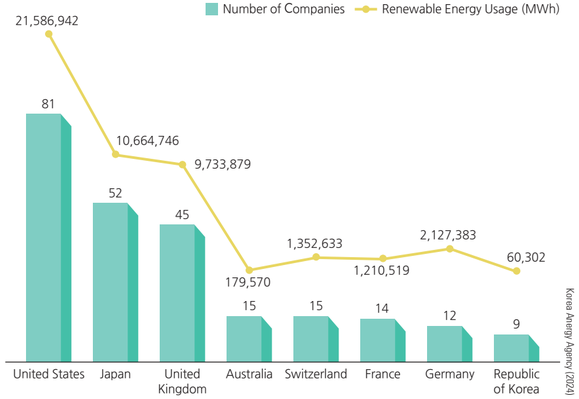
Institute of Information & Communications Technology Planning & Evaluation (2024)

Currently, global companies actively participating in the RE100 campaign are increasingly demanding the use of renewable energy from their suppliers or local partners, emphasizing RE100 through international financial or industrial networks. Likewise, various domestic companies are also being asked to implement RE100 by domestic and foreign trading partners. However, as of 2024, there were only 36 companies participating in the RE100 campaign in South Korea, indicating that, as a member of the international community, South Korea needs further growth in the production and use of renewable energy for future generations.

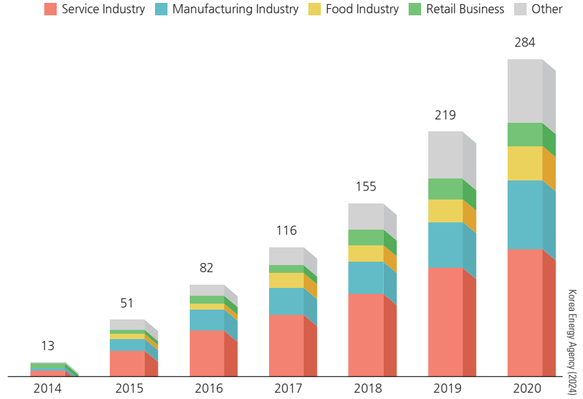
Capacity of Facilities Participating in the Renewable Energy Power Market



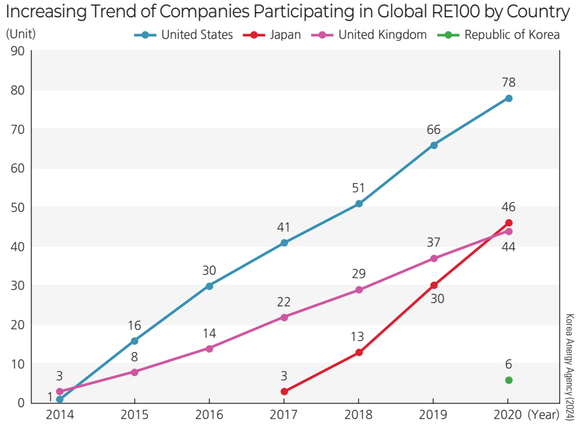
Number of Companies Participating in Global RE100 by Country



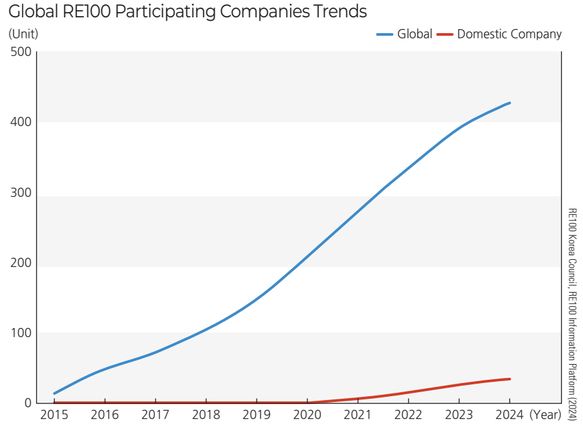
Number of Companies Participating in Global RE100 by Industry



Increasing Trend of Companies Participating in Global RE100 by Country



Global RE100 Participating Companies Trends

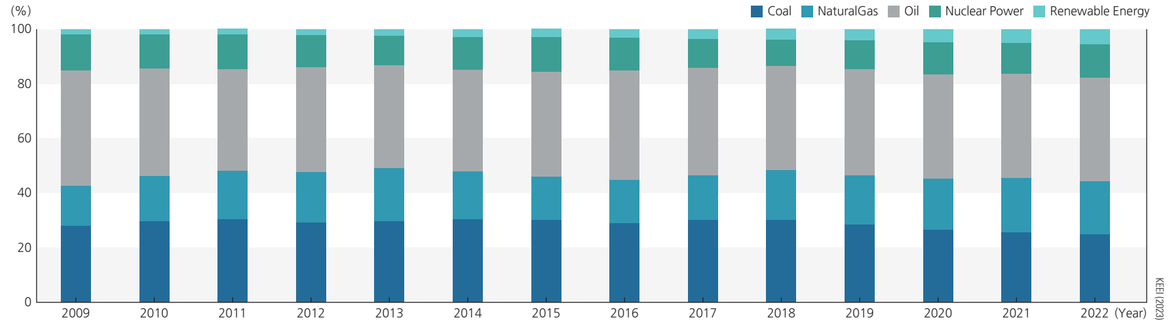


Status of Renewable Energy in South Korea

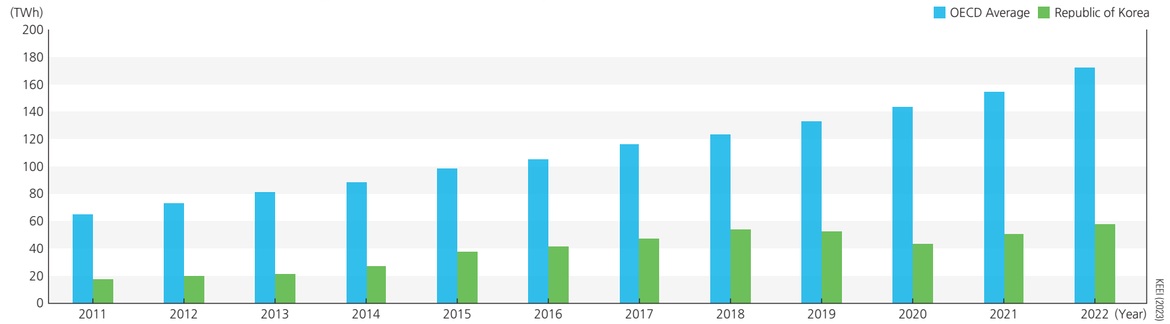
Renewable energy in South Korea has shown continuous and gradual growth since it was included as a category in energy statistics after 1990. However, as of 2022, renewable energy only accounts for about 6% of the total energy generation mix, which includes oil, coal, natural gas, and nuclear power. The amount of renewable energy generated in South Korea also remains relatively low at approximately 33% of the OECD average in 2022.

Renewable energy types can be classified into solar power, hydropower, bioenergy, fuel cells, wind power, ocean energy, waste energy, thermal energy, and the use of integrated gasification combined cycle technology (IGCC). Except for hydropower and waste energy generation, the generation and distribution capacities in all fields are gradually increasing.

Percentage of Power Generation by Energy Source

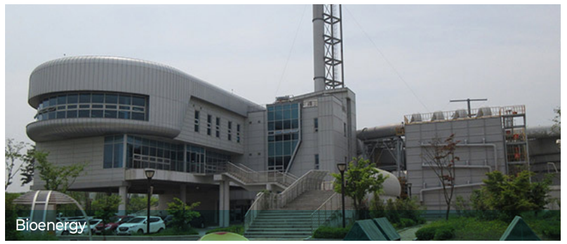


Generation of New and Renewable Energy Compared to OECD Average



Solar power generation is a technology that produces electricity by converting the sun's light energy, using solar cells that generate electricity through the photovoltaic effect when exposed to sunlight. As of 2022, it accounted for 53% of the total renewable energy generation in South Korea, making it the largest share among renewable energy sources. In addition, solar power generation is the most popular form of renewable energy generation, with significant shares not only in commercial but also in personal power generation compared to other forms. Regionally, it has a high proportion in areas with plains, such as Jeollabuk-do and Chungcheongnam-do, and in areas with salt farms, such as Jeollanam-do. Thanks to these geographical features, Jeollabuk-do ranked first in the nation for renewable energy production as of 2022.

Hydropower is a technology that utilizes the flow and potential energy of water. Before 2005, facilities with a capacity of 10 MW or less were classified as small hydropower, but current legal revisions define all hydropower as renewable energy. Hydropower types include dam power generation, canal power generation, tunnel and waterway alteration power generation, dam-canal power generation, and pumped-storage power generation. In South Korea, there are 21 dam power plants and seven pumped-storage power plants that are well known. According to Korea Hydro & Nuclear Power, additional pumped-storage power plants will be built in nine regions, including Yeongdong.



Bioenergy refers to a type of power generation that utilizes biomass in solid, liquid, or gaseous fuel form, or electricity and thermal energy through direct or biochemical and physical conversion processes. As of 2022, Jeollabuk-do produced 36.4% of the country's total bioenergy output, which can be seen as a result of intensive investment in bioenergy generation in Jeollabuk-do. In addition, Jeollabuk-do designated Buan-gun as a rapeseed pilot cultivation complex for biodiesel raw materials in 2007 and has been consistently attracting bioenergy-related companies. The province has also established and operated the Bioenergy Crop Research Institute to link sustainable agriculture and eco-friendly energy production in the region's agricultural production process.

Waste energy is a technology that produces fuel and energy by converting waste through processing and treatment methods such as pyrolysis, solidification, combustion, and gasification. This method includes power generation using landfill gas or incineration and is one of the most common forms of renewable energy in South Korea due to the relatively high ratio of waste energy production.

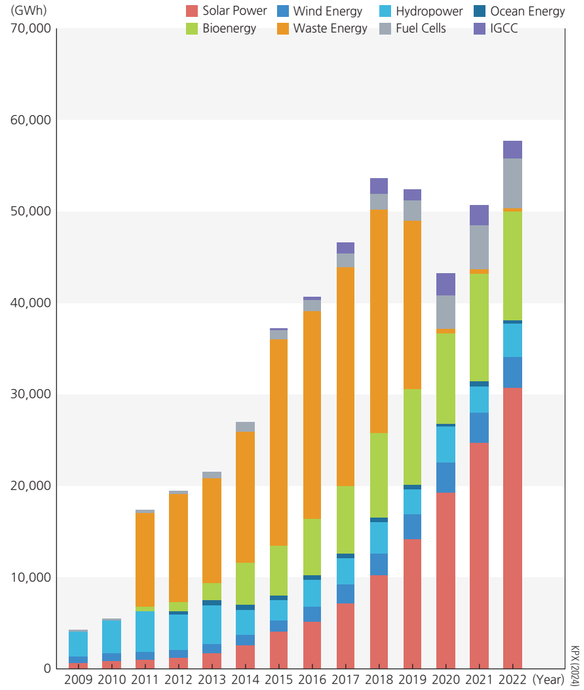
Fuel cells are power generation devices that convert the chemical energy of hydrogen (natural gas, methanol, coal, biomass) and oxygen directly into electrical energy through an electrochemical reaction while simultaneously producing heat. Although they account for a small portion of total renewable energy generation (3%), they have shown rapid growth due to technological advancements, with a 2570% increase in output from 2005 to 2022.

Ocean energy is a technology that converts tidal, wave, current, and temperature differences in the ocean into electricity or heat. In South Korea, the Sihwa Lake Tidal Power Station is a representative example of ocean power generation, and recently, there has been a review of the potential for ocean energy generation using discharge water from fish farms.

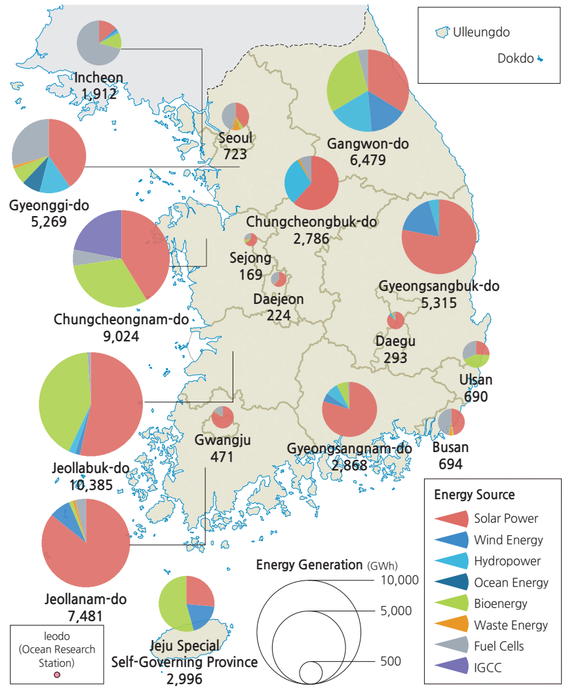
Wind power generation is a technology that converts the force of the wind into rotational force to generate electricity, which can be supplied to the power grid or consumers. Wind power can generate electricity wherever there is wind, is easy to install, and is cost-effective. However, due to the large size and noise of the generators, it is difficult to install them in urban areas, so they are mainly located in rural, mountainous, and coastal regions. In the case of Jeju Special Self-Governing Province, about 19% of the total renewable energy generation comes from wind power.

IGCC is a technology that generates electricity by gasifying fuel to produce high-temperature gas, which then drives a gas turbine and a steam turbine. While IGCC generation is included as renewable energy in South Korea, it is not considered a sustainable energy source because it involves fossil fuels.

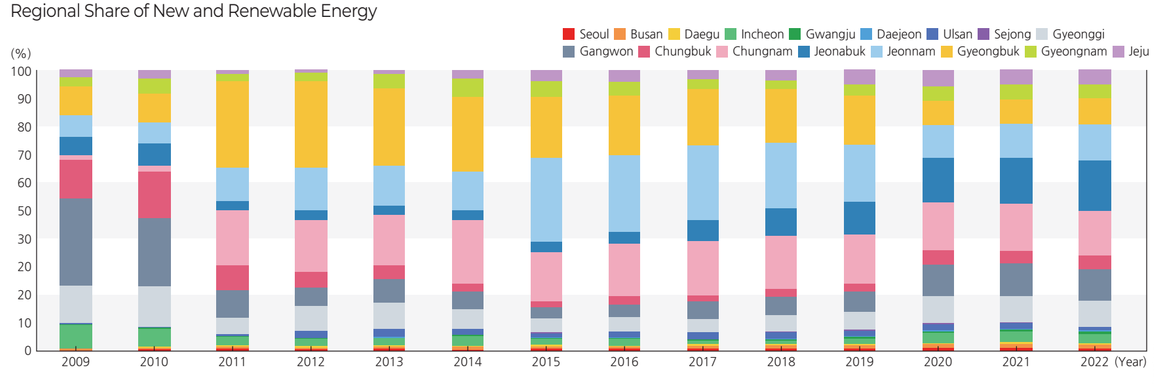
Total Generation of New and Renewable Energy



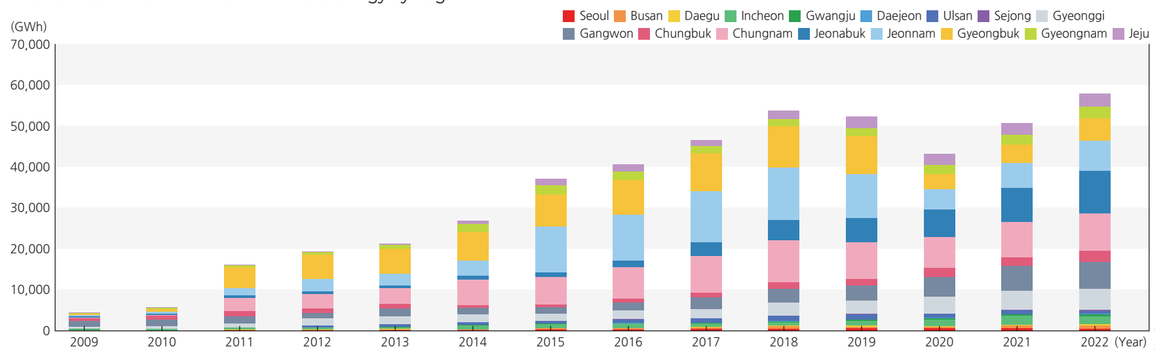
Power Generation by Region and Renewable Energy Sources



Regional Share of New and Renewable Energy



Total Generation of New and Renewable Energy by Region



Understanding the Meaning and Value of Korean National Territory

In a dictionary sense, national territory refers to the area over which a nation's sovereignty extends, encompassing land, sea, and air. It is considered an exclusive domain that must be protected from external invasion. In an economic sense, it refers to the basis for national production activities, and when considering the use value of land and resources, a national territory can be regarded as a "space of production." Additionally, it can be considered a "space of living," as it is a collection of places where people residing within the national territory conduct all kinds of activities.

The Korean national territory is primarily recognized as a "location," which can be divided into absolute location and relative location. Absolute location is determined by longitude and latitude, based on the Geodetic Datum of Korea located at the National Geographic Information Institute. The absolute location of the Republic of Korea is as follows: extreme west at 124° 10′ 47″ east longitude, extreme north at 43° 00′ 36″ north latitude, extreme east at 131° 52′ 22″ east longitude, and extreme south at 33° 05′ 45″ north latitude.

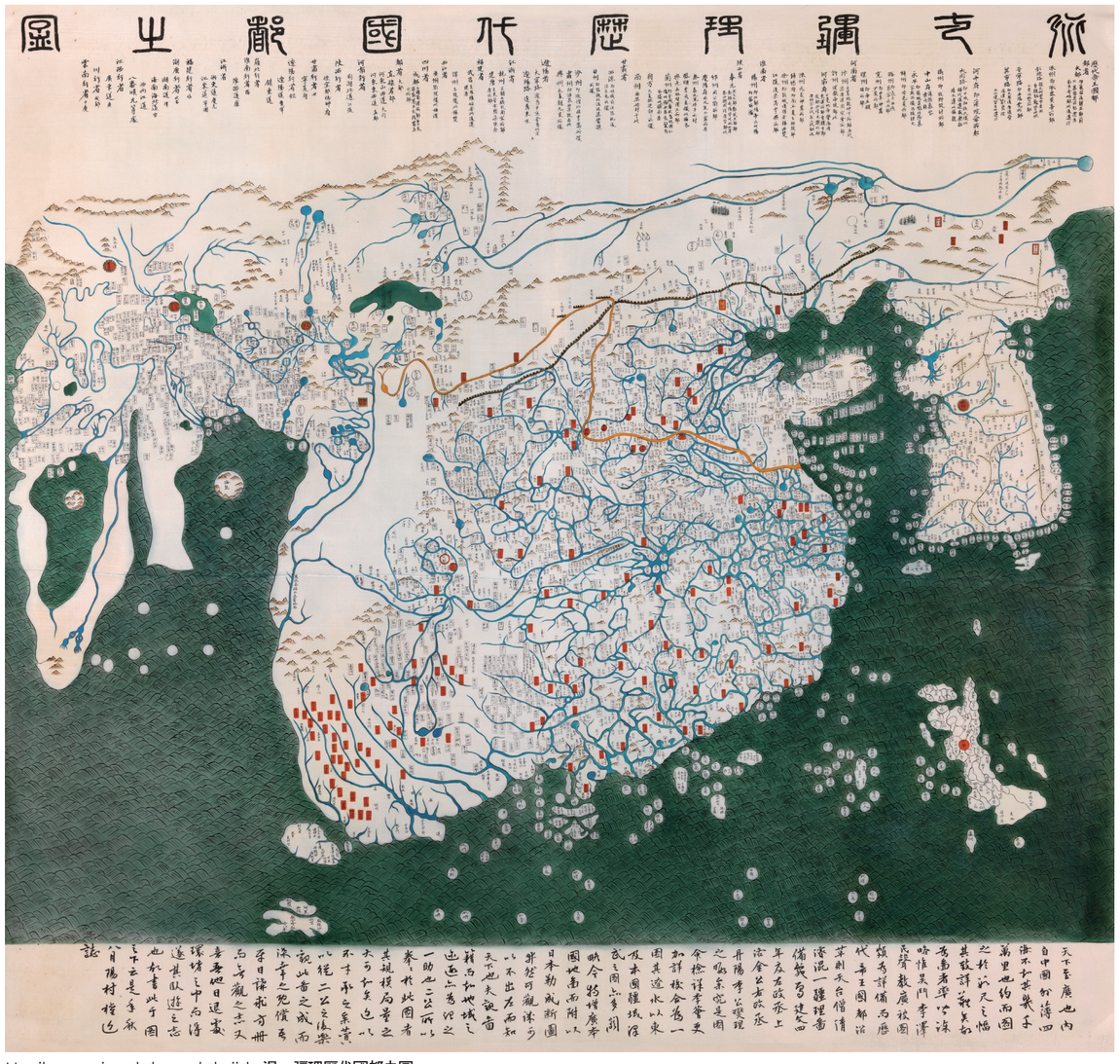
Concept and Perception of National Territory

South Korea's extremes

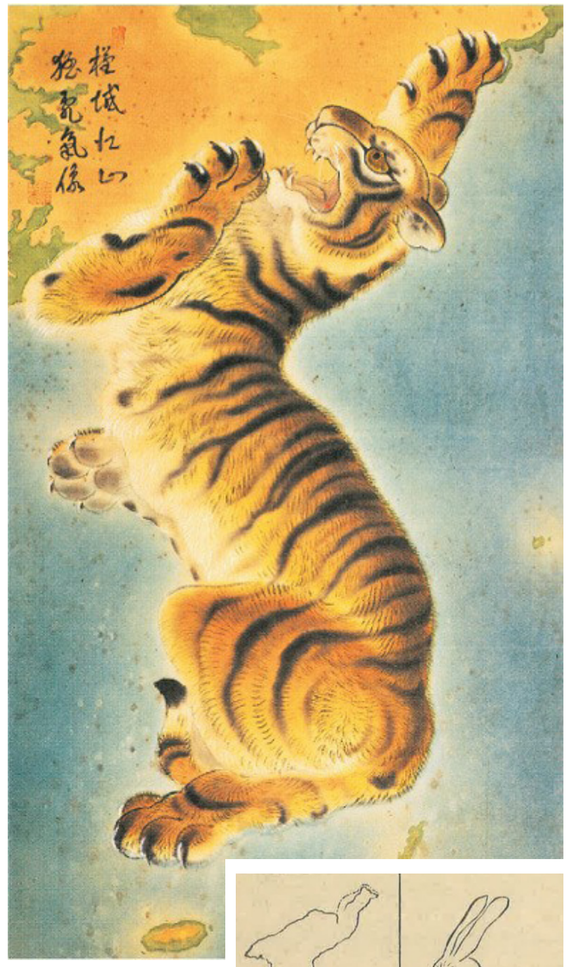
In contrast, the relative location of a national territory is a variable and flexible location influenced by the situation of neighboring countries or other nations. Relative location, which changes according to foreign political, economic, and social relations, is greatly affected by the context of the times and international affairs. Moreover, the changing relative location has significantly influenced the perception of Korea's national territory among citizens. The depiction of the Korean Peninsula and surrounding areas on old maps often appeared exaggerated or diminished, depending on the relationships with neighboring countries during the Goryeo and Joseon dynasties.

In pre-modern times, the perception of Korea's national territory was mainly characterized by the division of regions according to the distribution of mountains and rivers. The administrative divisions during the Goryeo and Joseon dynasties were derived from traditional regional divisions, and the contemporary perception of national territory and regions can be found in *Taekriji*, written by Yi Jung-hwan in the late Joseon period in 1751.

The Korean Datum of 1985 Origin



Honil gangni yeokdae gukdo jido 混一疆理歷代國都之圖



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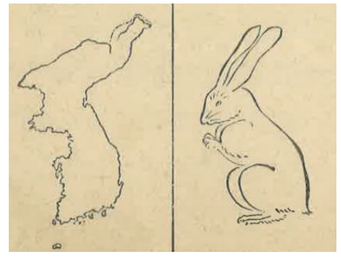


The perception of Korean national territory in the modern era was concretized through geography education following the reorganization of the educational system. Geography textbooks produced by various authors during the late Joseon period, the Korean Empire, and the Japanese colonial period described the absolute location of the Korean Peninsula and, at the same time, organized its relative location mainly through the descriptions of it as a peninsula nation or in relation to bordering countries or seas. In particular, geography textbooks for middle schools published in the mid-1930s described the Korean Peninsula as "the main trunk of world transportation from Siberia to Japan," highlighting its favorable location connecting the Asian continent and Japan, reflecting the geopolitical implications for Japan and neighboring countries, which sought to expand into Northeast Asia using the Korean Peninsula as a bridgehead. Additionally, these contemporary geography textbooks shaped or reflected a specific perception of national territory through education, likening the shape of the Korean Peninsula to a rabbit, for instance.

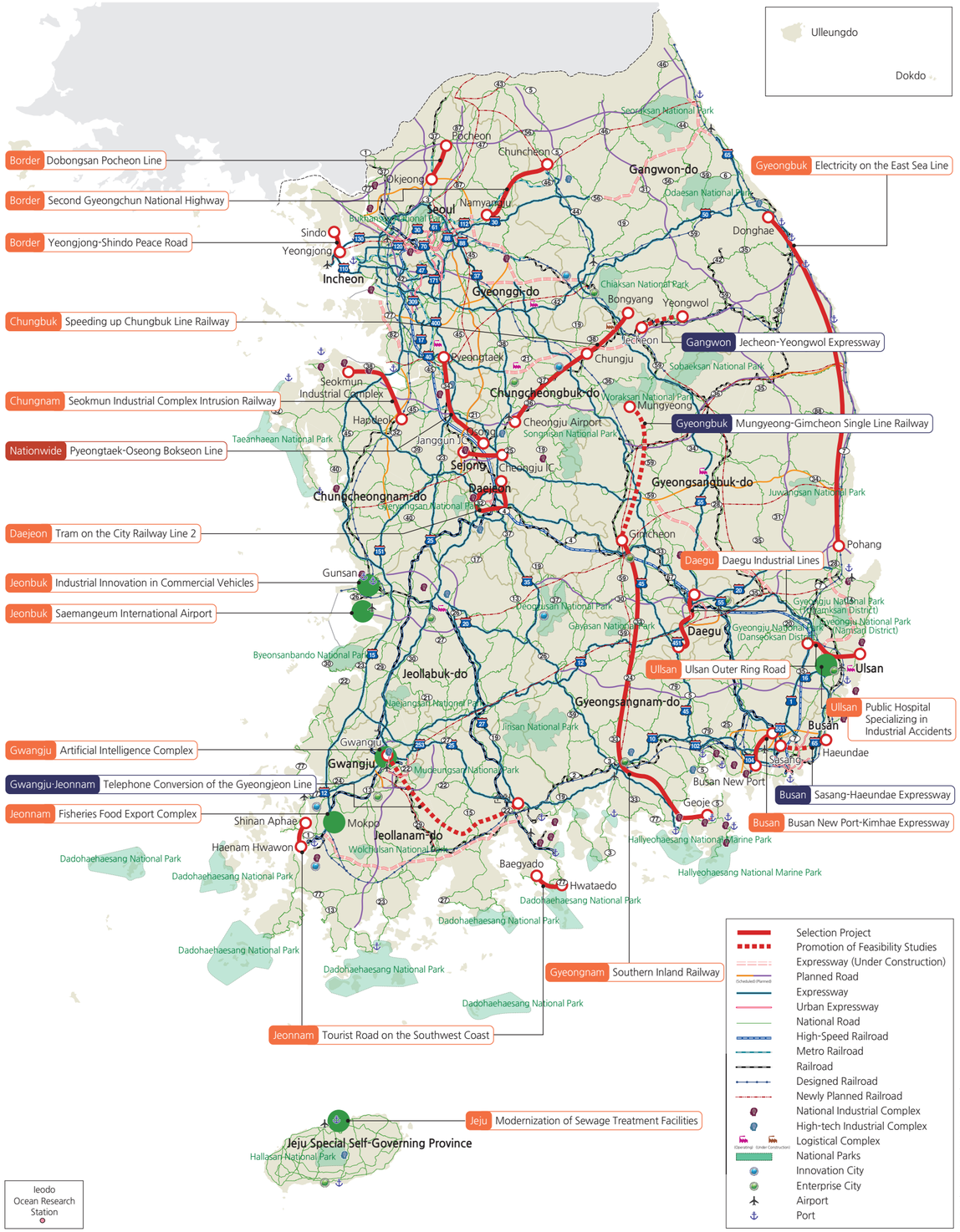
4th National Land Comprehensive Plan Amendments (2011–2020)

The Korean Peninsula lies between the Asian continent and the sea. Korea's relative location, the perception of the national territory as a peninsula, has been used to explain the repeated invasions and colonization by surrounding powerful nations that Korea experienced in the past. This perception was also used to understand and explain the contemporary situation during the Cold War period following the Korean War. It explained the relative location and geopolitical importance of the Korean Peninsula as a point where communist forces led by the Soviet Union and the liberal camp of the United States and its allies faced each other, emphasizing that our national territory, located on a peninsula and surrounded by powerful nations, inevitably suffered the pains of war as a small nation.

Alongside such geopolitical fears that shaped the perception of our national territory, there was also a perception that interpreted this relative location as a geopolitical hope. In the 1970s, the relative location of the Korean Peninsula, due to its geographical shape and features, was considered an economically advantageous position that could reach out to continental and maritime forces rather than merely enduring invasions. The first Comprehensive National Territorial Development Plan, initiated in 1971, emphasized securing a "bridge to reach out to the world," with industrial areas located in the southeastern coastal regions of the Korean Peninsula.

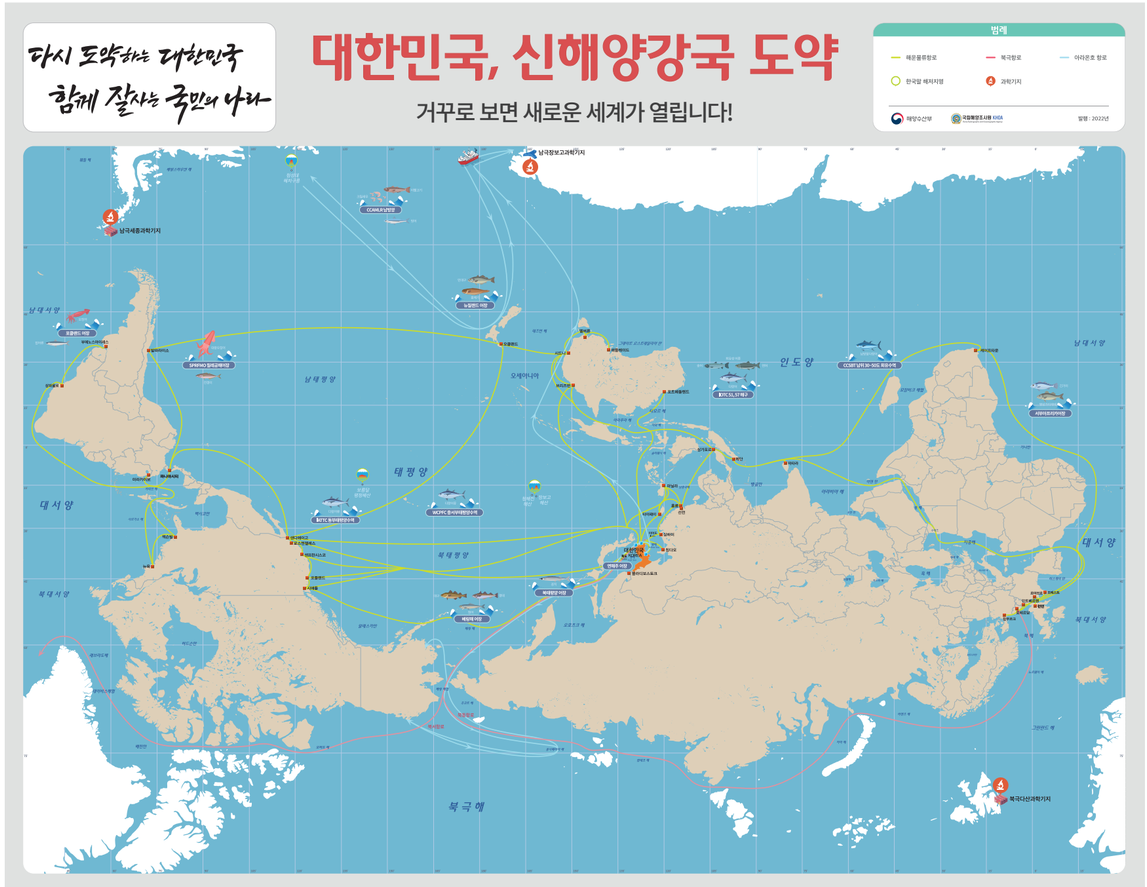
The perception of Korea's national territory, imbued with geopolitical hope and potential, repeatedly appeared in the Comprehensive National Territorial Development Plans that continued after the 1970s. The fourth Comprehensive National Territorial Development Plan, revised in 2011, emphasized the need to respond to the intensification of global competition and to enhance competitiveness through an open perception of the national territory. Particularly, the Comprehensive National Territorial Development Plan, centered on high-speed transportation means such as airports, ports, and high-speed railroads, and on global infrastructure, expressed the relative location of the country in the global era in a way that completely reversed the peninsular limitations of the past.

5th National Land Comprehensive Plan Amendments (2020–2040)



Ministry of Land, Infrastructure and Transport (2023)

The "Upside-Down World Map," distributed by the Ministry of Oceans and Fisheries in 2017, was also created with the purpose of enhancing the public's interest in and perception of the potential of our national territory to extend into the sea. Unlike traditional maps, the "Upside-Down World Map" was created by placing the Northern Hemisphere at the bottom and the Southern Hemisphere at the top, with the Korean Peninsula at the center, spreading out over the vast Pacific Ocean, depicting our country's proactive maritime policy to advance into the world through the sea routes. This allows for an examination of the achievements of our country's maritime expansion, such as the development of shipping routes and polar routes and the establishment of polar scientific bases. Minister of Oceans and Fisheries, who served at that time, emphasized through the upside-down map that our national territory, with China and Russia as its hinterland, is akin to a wharf, and thus a strategic location for maritime advancement.



Ministry of Oceans and Fisheries Gunsan Regional Office of Oceans and Fisheries (2022)

As such, the meaning and value of Korea's national territory can be understood in quite different forms depending on the combination of numerical and relational positions, international situations, and the political and policy objectives of our country. Therefore, the perception of our national territory can change in different directions through turning points such as the situation of the times and the development of technology. Based on an understanding of the variability of such perceptions, the *National Atlas of Korea* aims to reflect our nation's values regarding national territory and confirm our national identity in line with its editorial intent.