Land Use and Land Cover

Over time, Korea has experienced various changes in its patterns of land use. Urban construction took root in basins and along major rivers, and cities gradually expanded with population growth. Roads and railways were constructed to connect cities, leading to the further development of new metropolitan centers in surrounding areas. Farmlands for crop production and pastures for livestock also increased throughout the years. Hills were cultivated for upland farming fields, many of which have been converted into rice paddies through modern irrigation methods. In recent years, however, there have been instances where rice paddies have been converted into upland farming fields in order to grow more lucrative products such as ginseng, fruits, and highland vegetables. In coastal regions, new land has been created by reclaiming land from the sea.

Although land use has shifted to fit our demands throughout time, such changes have the potential to cause serious environmental problems. The expansion of urban and agricultural areas inevitably led to the decrease of forest areas, which in turn triggered an increase in greenhouse gas emissions and the risk of natural

hazards. Forest fragmentation resulting from the construction of residential areas, roads, and railways threatens plants and animals living in the forest ecosystem. Environmental problems such as odor and leachate arise due to waste landfills in metropolitan areas. Coastal land reclamation has caused a decrease in tidal flats, leading to biodiversity loss and an increased danger of nearshore disasters.

Korea has been making various efforts to minimize environmental problems and achieve sustainable land use. Land cover and land use maps have been developed to understand the status of the earth's surface and analyze the best land use practices. Along coastal shorelines, surveys are in progress to assess and monitor the restoration of marine organism habitats that have been destroyed by public water reclamation. Waste landfill areas that are located near big cities are being developed into parks in order to minimize odor and leachate. Furthermore, Korea aims to prevent inappropriate development practices with the launch of the National Environmental Zoning Map and encourage eco-friendly land use by sharing regulatory information with the public.

South Korea and North Korea display a large difference in land use and land cover patterns. South Korea has an area of approximately 100,000 km², while the area of North Korea is about 120,000 km². According to a land cover map from the late 2000s (2008–2010) produced by the Ministry of Environment, the total size of all urban and developed areas of South Korea is approximately twice that of North Korea. According to the World Bank, as of 2016, the cultivated land area in South and North Korea accounted for 14.5% and 19.5% of the total land area, respectively. The ratio of permanent arable land in total land area is 2.3% in South Korea and 1.9% in North Korea. In South Korea, forested areas occupy 63.4% of the total land area, and in North Korea, they account for 40.7%. High mountain areas are mostly located in the eastern and northern regions, while low elevations and gentle slopes primarily appear in the western region. Due to these topographical features, agricultural areas are mainly distributed in western regions, and forest areas are located towards eastern regions.

Land Use and Cover

Land Cover Map of the Korean Peninsula



Ministry of Environment (2019)

Land Cover Changes

The Ministry of Environment produces land cover maps for Korea. According to the maps, since Land Cover Map (1989) 1975, the urbanized lands have been expanded around large cities. At the end of the 1980s, urbanized lands accounted for 2.1% of the total land cover, and at the end of the 2010s, they accounted for 5.6%. During this period, urbanized lands increased by 2.7 times. In particular, urbanized lands have remarkably expanded in metropolitan cities such as Seoul, Busan, Incheon, Gwangju, Daejeon, and Ulsan. Areas surrounding the transportation networks between such metropolitan cities have also become increasingly urbanized.

While agricultural lands have shrunk in mountain areas due to a decrease in rural population, they expanded in coastal plains and hilly areas as a result of active land reclamation.

Agricultural lands decreased from 27,000 km² in the late 1980s to 22,000 km² in the late 2010s. Urban and agricultural expansion has also led to deforestation, which can cause various environmental issues such as global warming and flood hazards. Significant efforts are being made to minimize these potential environmental problems and heighten the value of forested areas. As such, forest resources are closely monitored, and forest protection areas are designated accordingly.

Changes in the Cumulative Proportions of Land Cover



Land Cover Map (1999)





Land Cover Map (2019)

Baeng

-nyeongdo

🐗 Ulleungdo Dokdo

Ministry of Enviro

Ministry of Envir



Ministry of Environment (2000

Major Land Use Patterns

National Land Cover Maps Level-2

National Land Cover Maps Level-3



Land Use of Seoul (2010)

Land Cover Classification by the Ministry of Environment

Residential

Industrial

Commercial

Communication

Transportation

Level-2

Level-1

Urban or Built-Up Land



Public Utilities Paddy Field Non-Irrigated Land Agricultural Land Protected Cultivation Orchard Other Cropland Deciduous Forest Land Forested Land Coniferous Forest Land Mixed Forest Land Natural Grassland Grassland Artificial Grassland Inland Wetland (Wetland Vegetation) Wetland Coastal Wetland Natural Barren Land Barren Land Artificial Barren Land Inland Water Water Seawater

The Ministry of Environment created a national land cover map to encourage effective land management and environment-friendly land usage. The map is constructed with data collected from satellites and aircrafts; in particular, information compiled by the Korea Multi-Purpose Satellite (KOMPSAT) has widely been used for mapping land cover types.

The national land cover map consists of three levels. The national land cover map is available to the public through the Environmental Geographic Information Service (http://egis.me.go.kr). The levelone land cover map includes the entirety of the Korean Peninsula and incorporates seven land cover types. The level-two land cover

map consists of 22 land cover types. The level-two map is useful for identifying the status of land use at a regional scale. It is also utilized for calculating the size of impervious areas and canopies to estimate streamflow. Additionally, it contributes to research for urban development and expansion, location selection for various facilities, and evaluation of potential natural hazards.

The level-three land cover map includes 41 types of land cover. This map analyzes land use at a local level within cities, districts, and provinces, and is particularly useful for biotope evaluation, assessment of green space in cities, and community mapping.

Level-3	
Single-Family Units	
Multi-Family Units	
ndustrial	
Commercial	
Complexes	
Communication	
Airport	
Harbor	
Railroad	
Road	
Other	
Environmental	
Educational	
Other	
Readjustment	
Non-Readjustment	
Readjustment	
Non-Readjustment	
Protected Cultivation	
Drchard	
Ranch or Farm	
Other	
Deciduous Forest Land	
Coniferous Forest Land	
Vixed Forest Land	
Natural Grassland	
Golf Course	
Cemetery	
Other	
nland Wetland (Wetland Vegetation)	
līdal Flat	
Salt Field	
Beach	
Riverside	
Exposed Rock	
Quarry	
Playground	
Other	
Stream and Canal	
ake and Reservoir	
Seawater	

Ministry of Environment (2010



Korea's major grain belts can be found across Mangyeongpyeongya and Gimjepyeongya. Collectively known as Honampyeongya, these alluvial plains are located in the lower regions of Mangyeonggang and Dongjingang. Located at the center of the plains is Gimje-si, which has the highest ratio of agricultural area among all local governments of Korea. Plains situated near streams or rivers are usually used as rice paddies, while forests and urban or developed areas are located on the hills.

The northeastern part of South Korea consists of Taebaeksanmaek and its surrounding mountainous areas. Cropland and roads have been developed along the many streams that run between the mountains. Although such geomorphological features make these areas difficult to access, they are also considered ideal vacation destinations due to their clean mountains and creeks.

Furthermore, high plantation surfaces located 1,000 m above sea level are widely used for vegetable fields and pastures.

Many cities such as Seoul, Chuncheon-si, Hongcheon-gun, Wonju-si, and Daejeon developed in erosional basins near large, flowing rivers. Due to the availability of water from rivers and underground sources along with a natural drainage system, these regions are typically seen as suitable locations for human habitation. Alluvial plains are also highly populated, as they possess fertile soil that is advantageous for farming.

Taebaeksanmaek runs parallel to the east coast, resulting in narrow coastal plains and small-scale ports. Wider plains can be found in areas where rivers flow into the sea. Since the 1970s, Pohang-si—a relatively wide urban area near Yeongil Bay—has been one of Korea's major steel industrial centers.



Plains Area



Mountainous Area



Urban Area



Coastal Area

Ministry of Environment (2020)



Urban Expansion

Expansion of Urban Areas (1980s-2010s)

Wate	2
ater	





Ministry of Environment (2020





Chungcheongna

0 5 km

Daejeon





Dokdo Gyeongsangbuk-o

Ulleungdo



Aerial Photo of Sejong Special Self-Governing City (2014)



Land Use of Sejong Special Self-Governing City (2014)

Sejong Special Self-Governing City, more commonly known as Sejong-si, is an administrative city near Geumgang that covers an area of 72.91 km². To balance national development and solve the overcrowding problem in Seoul, the city was conceptualized in 2003 and concrete measures began to take place in 2005. From 2007 to 2015, the peripheral areas of government buildings located northwest of Geumgang underwent intensive development, which involved drastic changes in land use as well as the landscape. For instance, many hills were converted into flatland and Sejong Lake-the largest man-made lake in South Korea-was created. However, extensive efforts are also being made to build Sejong-si as an environmentally friendly city. 52% of the planned development area has been designated for parks, green space, and water fronts, and a Green-Blue Network linking green corridors and stream corridors will be established. The government is also planning a wedge-shaped park system consisting of a central park connecting the green spaces of the city, and aims to reduce energy consumption by introducing a resource circulation system and promoting renewable energy.

Aerial Photos of Sejong Special Self-Governing City (2015)









Land Use of Sejong Special Self-Governing City (2019)



Ministry of Environment (2020)

Ministry of Environment (2014)







Sejong Special Self-Governing City (2015)

Land Use in Suburbs of the City

Gimhae Topographic Map







Land Use of Gimhae







Aerial Photo of Gimhae



National Geographic Information Institute

Facility cultivation refers to all cultivation methods that artificially control the environment for ideal crop growth. Although not common until the 1970s, such cultivated lands rapidly increased from an area of 4,971 ha (0.23%) in 1997 to 90,468 ha (5.39%) in 2015 as they guaranteed higher productivity than the winter. Also, areas that have easy access to irrigation water rapid changes in cropland use as a result of facility cultivation. raising crops outdoors. Natural and economic conditions must and fertile soil with good drainage are ideal. Facility cultivation

sunlight and temperature conditions directly influence crop growth, a flatland environment with long hours of sunlight, sufficient insulation, and a low heating load is favorable, especially during

be considered when installing a glass or PVC greenhouse. Since requires convenient traffic conditions or close proximity to warehouses, markets, airports, or container ports, and also needs an abundance of labor. The Nakdonggang midstream and estuary areas satisfy such conditions and have consequently experienced



National Geographic Information Institut

Ministry of Env



National Geographic Information Institut

Major Land Reclamation

The southwest seashore, a deeply-indented coast with a shallow marine environment, is favorable for reclamation due to its extensive well-developed inner tidal flats. Land reclamation work has been undertaken throughout Korea's history: for grain production and military provisions during the Goryeo and Joseon dynasties, and for rice production and land development during Japanese colonization. After liberation from Japanese rule, small

scale land reclamation projects were carried out to enhance the food supply and abolish famine. Further projects were pursued for comprehensive agricultural development after the 1970s and for multi-purpose development after the 1990s.

Large-scale reclamation has destroyed the marine habitat; pollutants from the land have damaged the marine ecosystem and its diversity. Unlike other developed nations, Korea has not been

making extensive shore restorations to repair affected regions. Central and local governments and organizations have carried out only some small-scale restorations since the 2000s. Restoring the coastal ecosystem is an essential task to maintain the ecological and social-economic capacity of the shores and promote further economic sustainability.





Satellite Images of Major Reclaimed Lands





























Land Reclamation by Ruling Powers (Ganghwado)



When the capital was transferred to Ganghwa in the 11th year of King Gojong of the Goryeo dynasty (A.D. 1232) due to the Mongolian invasion, the sudden surge in immigrants necessitated an enormous provision of food. As the war continued, the Royal Court planned a systematic reclamation project on coastal lowlands as its foremost agenda. In 1256, Jwadunjeon was reclaimed by building a dike in Jepo and Wapo, while *Woodunjeon* was reclaimed by blocking off Ipo and Choro of Yumha. During the period of King Gongmin, a new method of construction allowed for the blockage of deep tidal channels for wider land reclamation, as can be seen in the development of Yeongsaneon in the Injeompo area of Northern Gyodongdo.

Over the next 200 years (from the Joseon dynasty to the 1592 Japanese Invasion of Korea), no further large-scale reclamation projects were carried out. Afterward, Bipoeon, Bukjeokeon, Garieon, and Seondupoeon were built during the period of King Sukjong, with Seondupoeon being the largest reclamation project on Ganghwado. Reclamation on Ganghwado was completed in the late 18th century, and there was no longer any reclaimable land until the 1910s (except for the remaining salt ponds in southern Gulgotpo and Choji). Modern civil engineering technology in the 20th century has allowed for the resumption of reclamation work on some coasts, including the southern part of Ganghwado.



Gyodongdo, Ganghwa-gun, Incheon



Land Reclamation for Population Relocation (Seo-myeon, Seocheon-gun, Chungcheongnam-do)

1960s

10 km



10 kr



After the Korean War, a reclamation project was undertaken in the Dodun-ri area of Seo-myeon, Seocheon-gun, Chungcheongnamdo, which recruited war refugees as workers. Three to four households initially settled in 1954, followed by a steady rise of migrant settlement that resulted in approximately 100 households participating in the embankment project. Finished in 1961, the reclamation covered 614,876 m² of public water and introduced farming just three years after completion. Construction costs were paid with a private loan under the condition of repayment after full completion, and other liabilities were fulfilled by selling land to residents in nearby regions. After reclamation was complete, the land was apportioned among the immigrants according to the number of days they participated in the reclamation. The last reclamation project (Busa district) was started by a private enterprise in the late 1980s and was completed in 1991.



Seo-myeon, Seocheon-gun, Chungcheongnam-do

Developed and Barren Land
Diversity of Deservation
River and Reservoir
Forest
Irrigated Land
Non-Irrigated Land
Marsh
Sand Beach
Sea

Korea's First Large-Scale Reclamation: Seosan Reclamation Project

Since the 1970s, Korea has been utilizing independent technology to carry out extensive reclamation projects. The Seosan reclamation, launched in 1980 and completed in 1995, was the first large-scale project to be organized by a private enterprise in Korea. Although initial embankment work was completed in 1984, the large tidal range combined with a fast flow rate hindered the final stages. The project was successfully concluded in 1982 by sinking a discarded oil tanker to block the current.

The total length of the breakwater is 7,686 m, including District A and District B. The reclaimed area is 15,409 ha, with 9,626 ha of this land reclaimed in Seosan District A, and 5,783 ha reclaimed in Seosan District B. The reclaimed land is mostly used as agricultural land; the rice paddies in Seosan have become the largest administrative district in Korea. This project also created the Ganwol reservoir (District A) and Bunam reservoir (District B). Ganwoldo, which has been connected to the mainland, has become a tourist attraction known for its oyster production.

The Seosan reclamation project contributed to the development of Seosan-si and provided a habitat for winter migratory birds. As a largescale agricultural zone, it is not easily accessible to humans and has lots of flattened grain, making it an attractive location for birds. Typical migratory birds are the Baikal teal, bean goose, and buzzard. However, after the construction of the breakwater, species such as the longbill have decreased, and there has been a decline in the water quality of the reservoir. Currently, various plans are underway to improve the quality of the water.



Satellite Image of Seosan Reclaimed Land (1983)



Panoramic View of Seosan Reclaimed Land (2007)



Gangwon-do

Gyeongsangbuk-do

Busan

Seou

Gyeonggi-do

Sejong

Chungcheongbuk-do

Incheon

Chungcheongnam-do Daejeon

Jeollabuk-do

Gwangju

Jeollanam-do

Seosan Reclaimed Land

Reclaimed Land

Group Dance of Migratory Birds (2011)

Land Cover Map of Seosan Reclaimed Land (2019)



Satellite Image of Seosan Reclaimed Land (2020)





U.S. Geological Survey (USGS) (2020)

Ministry of Environment (2020

World's Largest Reclamation: Saemangeum Reclamation Project

The Saemangeum embankment project began in 1991 and was completed in 2006. The total length of the embankment is 33.9 km; 28,300 ha of land and 11,800 ha of lake were created from the project. As the world's longest embankment, Saemangeum got its name by combining the first characters of Mangyeongpyeongya and Gimjepyeongya. As such, "Saemangeum" refers to the desire to establish new fertile lands that are similar to the Mangyeong and Gimje plains. The land use plans of Saemangeum have been modified four times since 1991, with the latest plan being determined in September 2014.

According to this plan, six types of land are to be developed: industrial/research, international cooperation, tourism/leisure, agricultural, urban, and nature/ecosystem. The Saemangeum project is expected to help the local economy by extending its land, creating rich agricultural space, securing water resources, and creating a tourism district. However, problems have arisen during the development process, including damage to mudflats and water pollution.

Current Conditions in Comprehensive Plans of Saemangeum



Satellite Images of Saemangeum Reclaimed Land





Satellite Images of Saemangeum Reclaimed Land (2020)



Saemangeum Development and Investment Agency (2014)

U.S. Geological Survey (USGS)

U.S. Geological Survey (USGS) (2020)

Coastal Restoration

Eulsukdo was created by combining Ilwuldo and Eulsukdo, which were the upper and lower halves of the island that was separated by the construction of the Nakdonggang estuary bank. On July 13th, 1996, Eulsukdo was designated as Natural Monument #179 (Bird Sanctuary of the Nakdonggang Estuary). Originally, the island was at high risk of being submerged due to its low elevation. The establishment of *Yunjungje* (underwater barrier) and active reclamation work encouraged many residents to move to the island. The island even became a horticulture supply center for Busan. With the completion of the Nakdonggang estuary bank in April 1987, however, the whole island transformed into a public park. The increase in the number of visitors resulted in damaged reed fields and intensified ecosystem degradation. In response, Busan nullified the development plan for Eulsukdo and instead designated it as a core preservation area. Effective restoration work over the next six years (1999–2005) successfully resulted in creating an ecological park.

Ecological Map of Eulsukdo, Busan



Eulsukdo Aerial Photograph (2012)



Satellite Images



30

National Geographic Information Institute (2012)





Migratory Bird



Eulsukdo Reed

Management of Landfill Sites

Historical Features of Nanjido





Nanjido, formerly used as a landfill site for Seoul and northern Gyeonggi-do, is now an ecological park. After it was first designated as a landfill on August 3rd, 1977, the site received 110.5 million tons of waste over the next 15 years until the landfill was finally terminated on March 19th, 1993. Within the landfill's area of 2.9 km², two huge waste mountains, collectively spanning 1.75 km², were created by piling up the waste.

As a result, Nanjido, formerly a low-lying area at an altitude of 8 m, reached 98 m above sea level. The Seoul Metropolitan government devised a plan to create an ecological park on this landfill site, which is now known as the World Cup Park. This park features five theme parks: Pyounghwa Park, Haneul Park, Noeul Park, Nanjicheon Park, and Nanji Hangang Park. Noeul Park and Haneul Park are directly located upon former Nanjido landfills #1 and #2. Currently, stabilization work is in progress and is scheduled to continue until 2022. Methane gas and other substances released from the closed landfill are used as heat energy sources for facilities at World Cup Park and Seoul World Cup Stadium.





Landfill in Nanjido



Landfill Leachate

Nanjido



After Landfill Covering

Historical Features of Metropolitan Landfill Area







Waste Burial at Metropolitan Landfill Area



Soil Covering at Metropolitan Landfill Area

The metropolitan landfills—under construction from 1989 until their opening in 1992—were established to substitute for the Najido landfill. They consist of four landfills and combined make up the world's largest waste landfill in terms of total area. The 1st, 2nd, and 3rd landfills are located in Geomdan-dong, Seo-gu in Incheon. The 1st landfill was closed in 2000, and the 2nd landfill is currently in use. The 4th landfill will be located in Daebeokri, Daegot-myeon and Hakun-ri, Yangchon-eup in Gimpo-si. The metropolitan landfills were initially scheduled to be terminated by 2016. However, new measures such as the introduction of a volume-rate garbage disposal system and enhanced recycling greatly reduced the volume of waste that was produced in the 1990s and 2000s. As a result, on June 29th, 2015, the local governments of Seoul, Incheon, and Gyeonggi-do agreed to extend the term for the metropolitan landfills to 2025. They also determined that substitute local landfills will be prepared before the end of the term. The closed 1st landfill has been converted to a wildflower garden and a sports park that now serves as a leisure site for local residents.



River Guide (www.riverguide.go.kr)

U.S. Geological Survey (USGS)