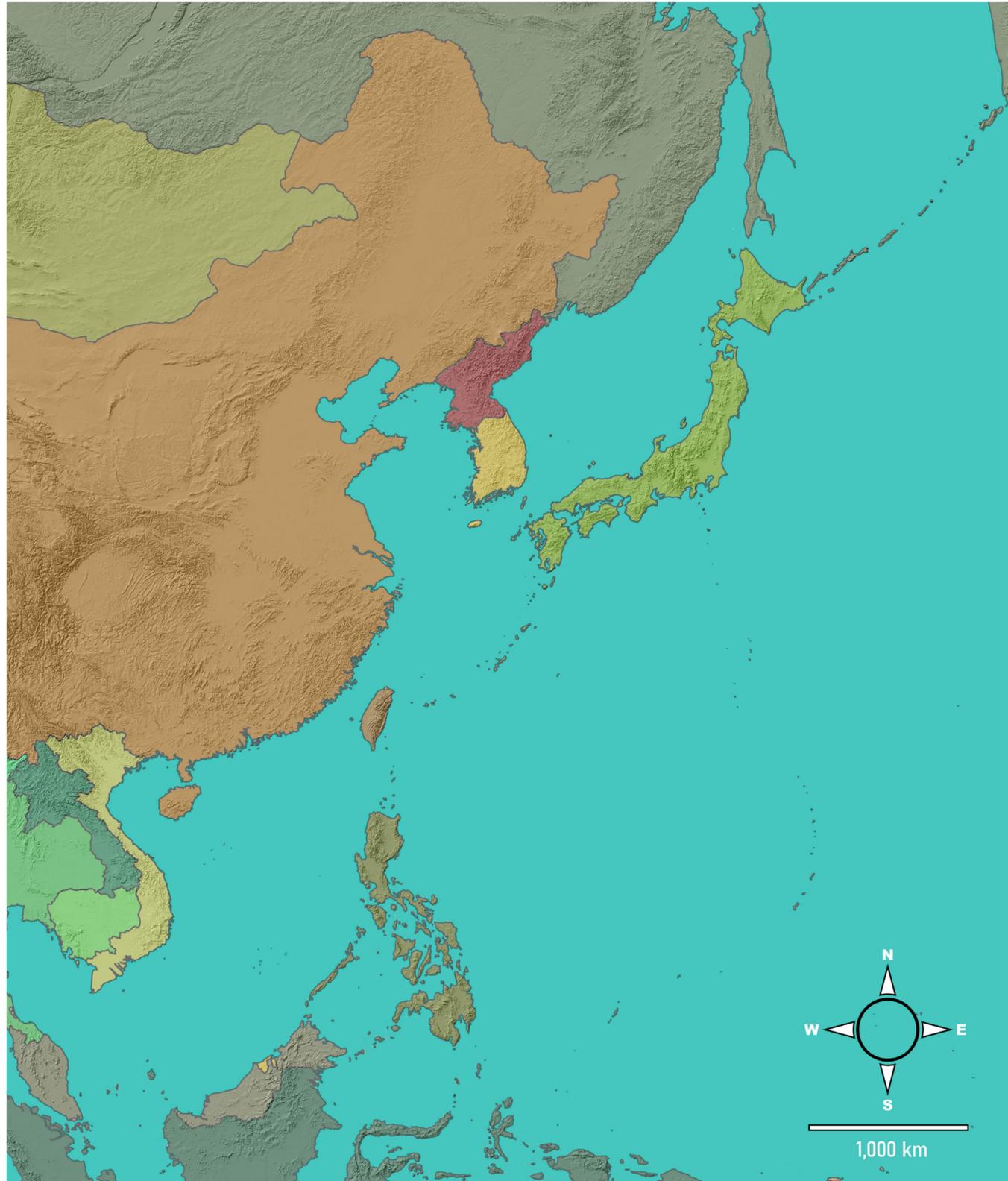


# KOREA: A GEOGRAPHIC PERSPECTIVE



A map of the East Asia region, showing North and South Korea and neighboring countries. Maps can efficiently convey information about complex phenomena in a beautiful and artistic way. The geographic perspective, with an emphasis on cartographic representations of spatial data provides a good method for exploring and understanding the fascinating country of Korea.

# An Exploration of Korea through the Lens of Geography



Statue of King Sejong at Gwanghwamun Plaza in Seoul, the Capital of South Korea.



Rice Farming



Traditional Food



Apartments in Seoul

Korea sits at the edge of earth's largest continent, on the shores of the largest ocean, where Asia meets the Pacific. Due to its special location, Korea acts as a gateway to East Asia, well-connected to other countries in the region and across the globe. Ships and planes easily transport people and materials between Korea and trading partners worldwide.

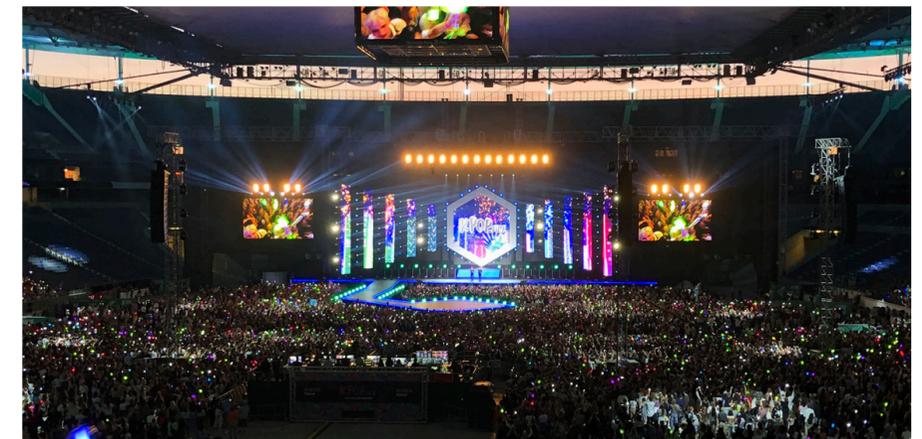
Korea is on a peninsula—an extension of land bordered on most sides by water. Koreans living on the east coast can watch the morning sunrise over the East Sea. In the evening, those on the west coast see the sunset over the Yellow Sea. A narrow body of water, the Korea Strait, separates the southern part of the peninsula from the island nation of Japan. To the north, the peninsula connects Korea with two countries: China and Russia. The territory of Korea, including several islands in the seas surrounding the peninsula, extends from about 33 to 43 degrees north latitude, placing it in the temperate mid-latitude zone. This gives Korea a moderate climate with warm, rainy summers and cold winters.

For thousands of years, Korea has been unified by a distinct language and identity. A long tradition of scholarly and artistic pursuits is reflected in the architecture, literature, and culture of the country. Unfortunately, after the Korean war in the 1950s, Korea was split into two countries: North and South Korea. In the decades since the war, the economy and quality of life in South Korea have improved greatly. South Korea has emerged as an economic powerhouse, exporting high-tech items such as smart phones and automobiles and sharing its unique food, music, and culture with the rest of the world. As it

draws on its deep roots and its rich history, South Korea continues to make use of its recent prosperity in a responsible way, engaging in beneficial exchanges with other countries, contributing new ideas, and forging new partnerships as a critical member of the global community.

This atlas paints a portrait of Korea from the perspective of the discipline of geography, a field that reflects both scientific and artistic insights. The maps and graphics presented here are based on real-world observations, scientific analyses, and a precise representation of quantitative, spatial

data. Given Korea's rich layers of history and the accelerated developments of recent decades, this atlas attempts to illustrate the country according to cartographic principles of design in a way that is both succinct and beautiful. Just as the perspective of an artist provides a fresh way to see and understand a subject, the geographic perspective is well suited for encapsulating complex and subtle ideas. Thus, a recurring theme of this atlas is the application of the traditions of geography and cartography to paint an accurate and compelling portrait of the remarkable country that is Korea.



Korean culture, including music, film, and cuisine, has become popular around the world.

# Where is Korea: The Art and Science of Map Projections



In this painting, the artist sets a woman with a red umbrella into the context of a larger landscape, with a conglomeration of urban buildings against a backdrop of distant mountains. The scene is Seoul in the 1920s. How do the artist's choices affect the mood and general impression of this work? What choices might have been used to different effects?

Kim Chu-kyong, View with Mt. Pugak in the Background, 1929. Oil on canvas, 97.5 x 130 cm. The original is housed at the Museum of Modern and Contemporary Art, Deoksugung Branch, Seoul.

An artist faced with a blank canvas has many decisions to make regarding subject matter, scale, color palette, composition, line thickness, perspective, and framing. Each choice reflects what the artist feels about the subject and what ultimately will be conveyed to the viewer. In creating a map, a cartographer has a similar array of decisions to make about composition, perspective, color, and scale.

When interpreting the maps in this atlas, it is useful to be aware of how such choices can affect the presentation of the data. Different presentations of spatial data can have a large influence on the effectiveness and clarity of a map. One of the

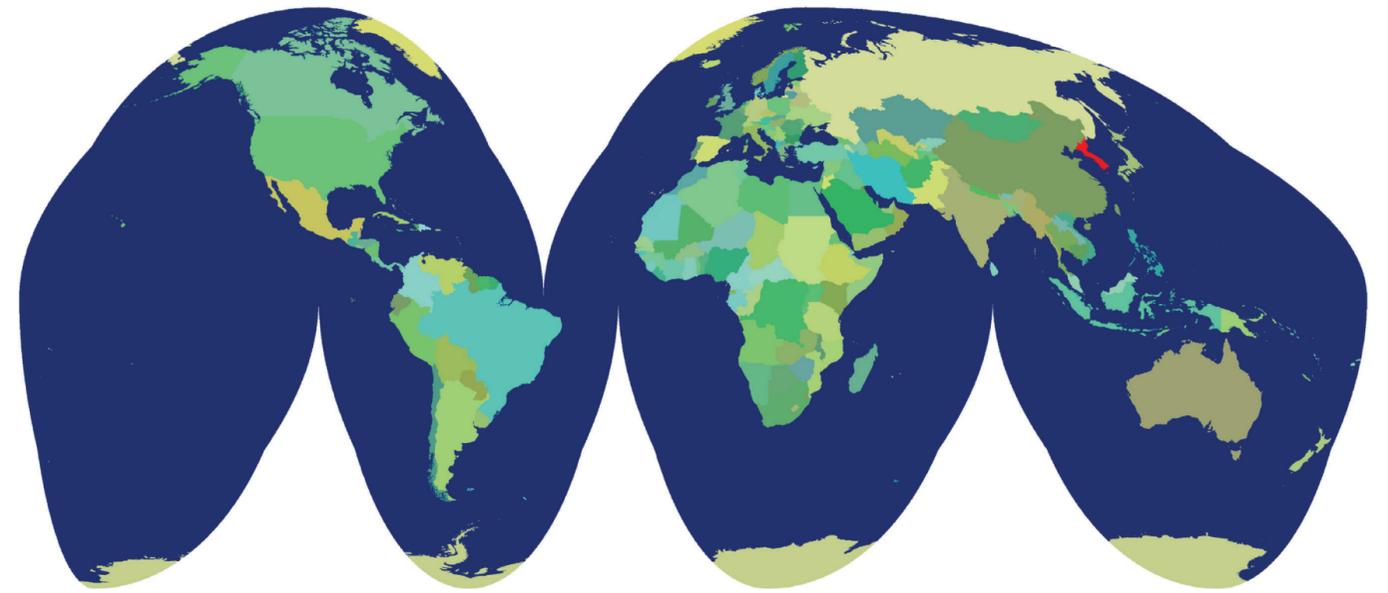
most important choices a cartographer makes is the choice of a map projection.

Just as there are different ways to create an artistic work using different media, there are many ways to paint a picture with maps. The maps on this page present a portrait of Korea (shown in red) in its global context. The way geographic features are shaped and arranged on a map is called a map projection. The map below uses what is called the Robinson projection, which is commonly used to show all of the continents.

Robinson Projection Centered on the Prime Meridian



Goode's Interrupted Homolosine Projection



Of course, the real Earth is sphere-shaped, like a ball, so that when a cartographer draws continents on a flat page, their shapes are slightly distorted. The Goode projection (above) is one way to reduce the distortion of the area of continents. It looks like an orange peel, so it's a good reminder that the map represents the surface of a sphere. You can almost imagine putting the peel back into a sphere shape, reattaching the edges of the Pacific.

Both of these maps put the prime meridian, running through Europe and West Africa, at the center of the map. These projections make it look like Europe and West Africa are at the center of the world and that Korea is off to the side, far from the Americas. A person reading these maps might picture Korea being away from the center of activity or remote. The heart-shaped projection below, on the other hand, emphasizes the Pacific Rim, the edge of the Pacific Ocean that borders the

Americas, the eastern coasts of Asia, Australia, and the islands of Oceania. Since Korea lies on the Pacific Rim, this arrangement shows Korea in a more central position and makes it easy to see how ships can go from Korea directly across the Pacific to reach other points on the Pacific Rim. It also shows how close Korea is to other parts of Asia.

The azimuthal equidistant projection shown below at right places Seoul, the capital of South Korea, at the center of the map. This projection distorts the shapes and areas of continents. For example, South America is stretched out in a big arc across the top and right of the map. But the projection is helpful for showing the correct direction (azimuth) and distance from the center point to other places on the map. For example, the shortest route for a plane going from Seoul to New York, 11,000 km away, is to fly over the Arctic Ocean.

Bonne Projection Centered on the Western Pacific Ocean at 150° East Meridian



Azimuthal Equidistant Projection Centered on Seoul, South Korea



# Areal Imagery of Korea



Seoul by Day (Left) and by Night (Right)

Source: NASA Satellite Imagery

New technologies in satellite remote sensing and aerial imaging allow the collection of a variety of measurements of the earth's surface at high resolution. Above is a visible-light image of the region, including Seoul, the capital of South Korea. The river Han features prominently in the image as the dark blue, wavy line. The blue area at left is the Yellow Sea.

When interpreting a remotely-sensed image, it helps to be familiar with the area from experience, but you can also use various other clues to interpret the features and land cover categories represented. This image has colors very similar to those that you would see with the unaided eye from an airplane; green areas represent forested or vegetated areas, whereas gray areas represent urbanized regions with

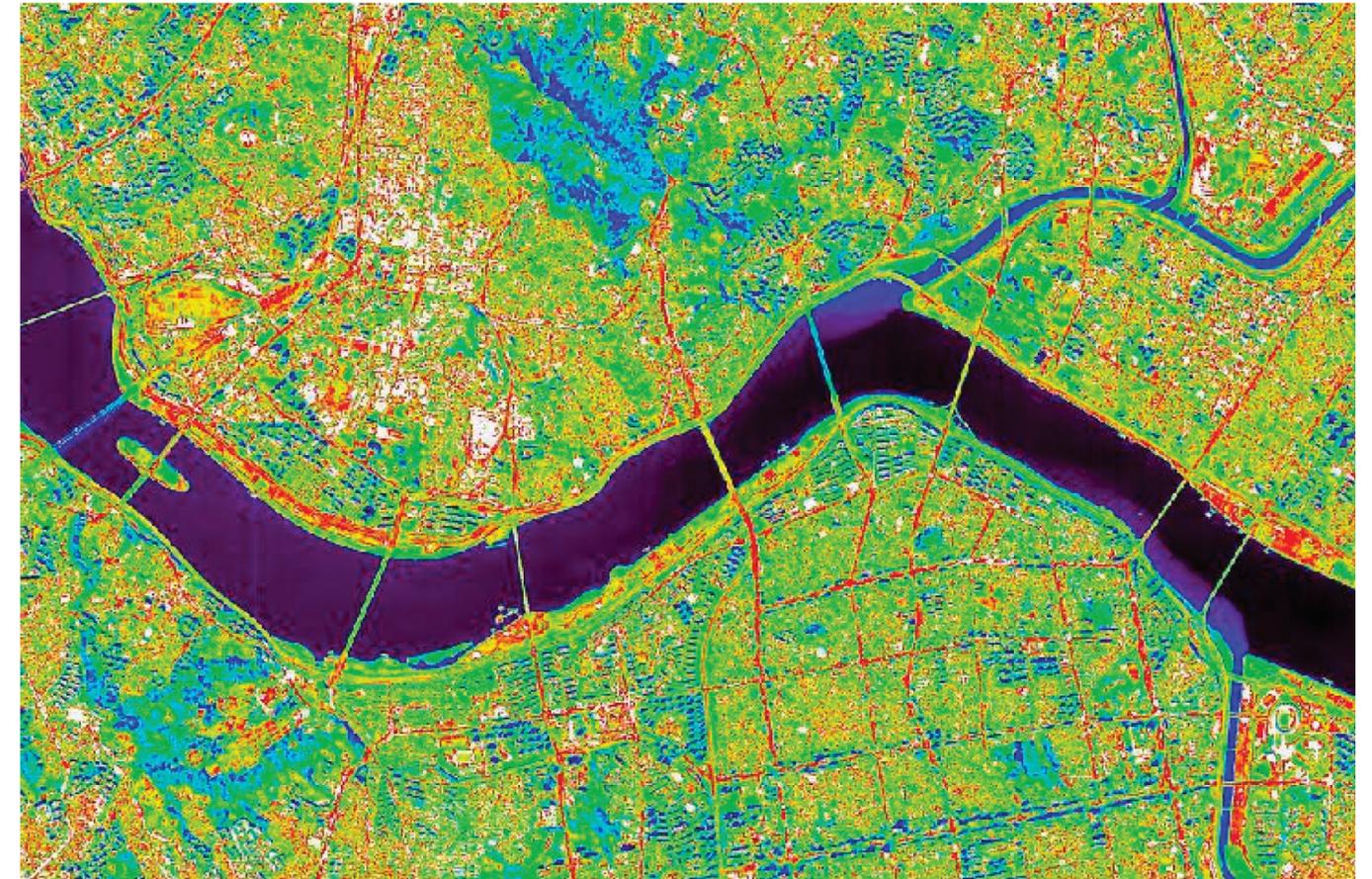
many buildings. Some information about topography can also be deduced from the image. Subtle shading of the mountains indicates peaks, ridge lines, and slope aspect (direction of slope). A sharp boundary separates dark green, mountainous areas from heavily urbanized regions.

The image at right shows a similar aerial view of Seoul taken at night. Again, the River Han is prominent. The lights indicate the density of urbanization and clearly highlight the network of streets and roads throughout the city.

Compare these images to the oblique air photo shown below, taken from an airplane looking across the river. When interpreting aerial or satellite imagery, it helps to have ground-based data for comparison and verification.



Aerial Photograph of Seoul, Showing Condominiums (Foreground), the Han River, Heavily Urbanized Central Seoul, and Mountains in the Distance



Thermal Imagery of Seoul

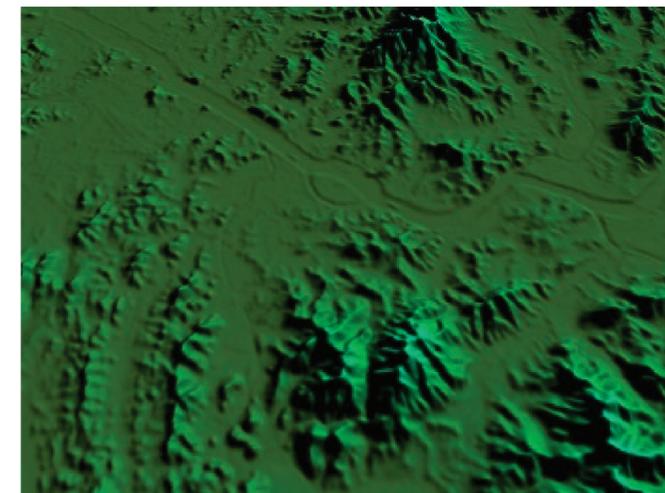
Source: KARI

The image above is collected by a sensor that detects thermal infrared emissions, with colors corresponding to the temperature of objects at the earth's surface. Cooler surfaces appear as blue or green, and warmer surfaces are as red or white. The Han River appears as dark blue and is the coolest surface indicated. Tributaries to the Han have a slightly warmer temperature and a lighter color blue. This warmer water from can be traced some distance downstream of the confluences before mixing reduces the temperature contrast.

Dense urban areas with many buildings, paved surfaces, and less vegetation appear as white or red. Streets and roads appear as red. Such an image can be useful to document

the extent of an urban heat island effect, with elevated temperatures in city centers.

Raw imagery collected by remote sensing equipment can be further processed to create derived imagery for various purposes. The green image below is a three-dimensional digital elevation model that indicates the topography around Seoul. Below at right is a vectorized image showing street networks across the city. In creating map products that present remotely sensed data, geographers apply the principles of cartography to generate images and maps that are not only functional as tools for analysis, but are also beautiful and can be considered works of art themselves.



Digital Elevation Model of Seoul

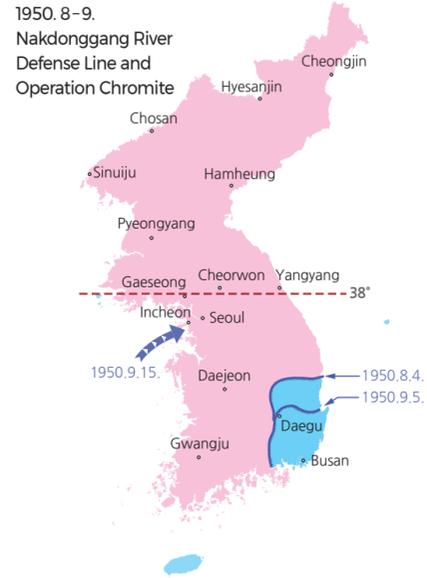
Source: NGII



Aerial imagery can form the basis of derived map products, often with the aesthetic appeal of a work of art.

# A Divided Peninsula: North and South Korea

**Korean War**  
1950. 6. 25.  
Outbreak of  
the Korean War



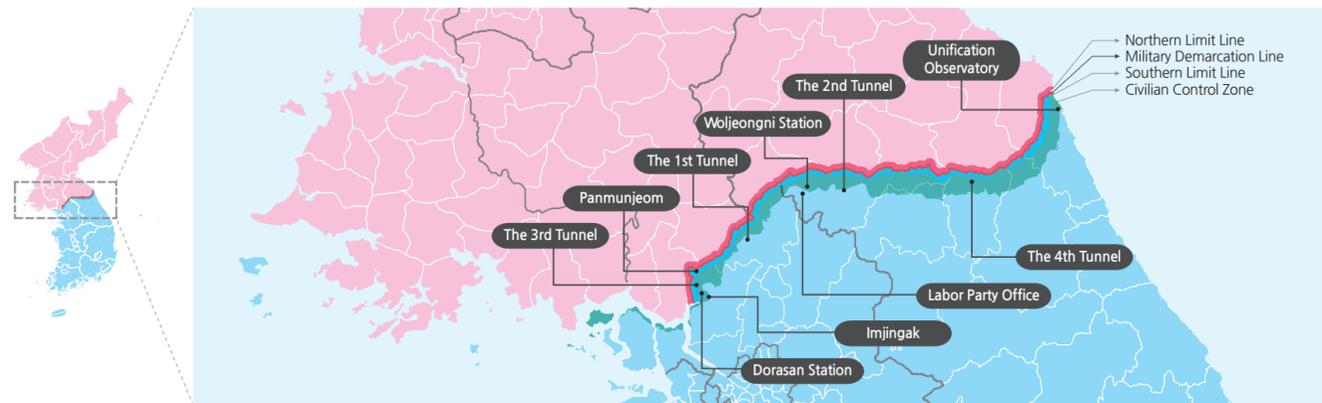
**One Peninsula, Two Nations**  
For many students learning about Korea, one of the most pressing questions is about the history of the division between North and South Korea. A nighttime image (at right) shows the stark contrast in the degree of development between North and South Korea.  
After World War II, Korea was divided into North and South along the 38th parallel (the line of latitude 38 degrees north of the equator). Korea then suffered a tragic war, the Korean War (1950-1953). A truce line near the 38th parallel has separated the two Koreas ever since. Although there have been competition and tension between the two Koreas, there have also been many sincere efforts to overcome the division with trust-building events, such as holding reunions for separated families, inter-Korean meetings, and cooperative economic endeavors.



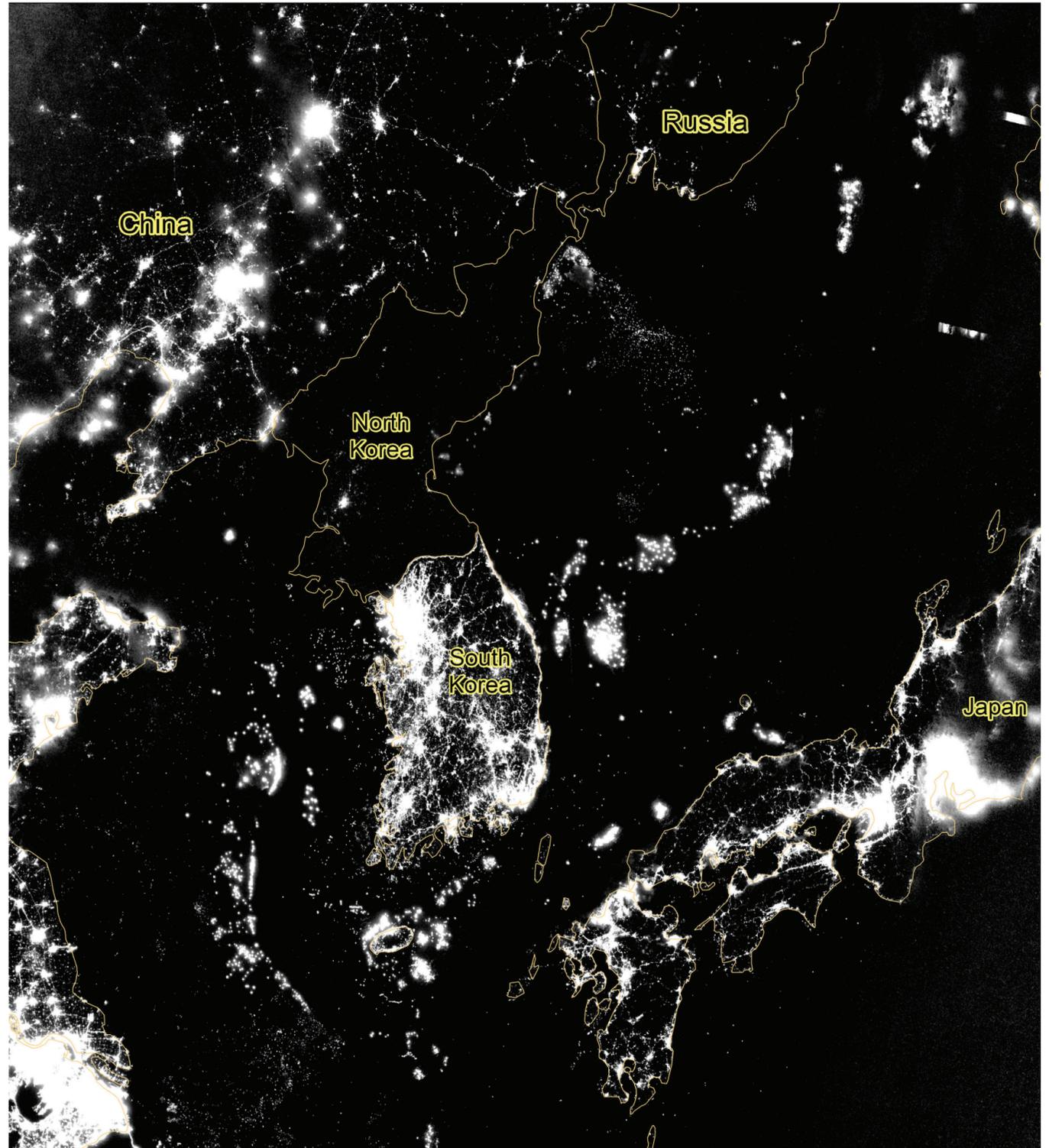
The Demilitarized Zone (DMZ) is a 4-km wide buffer zone along the border between North and South Korea where military activities are not allowed. The area is off-limits to civilians and so is uninhabited. Just outside the zone, the borders are heavily guarded. Because the DMZ is almost untouched by human activity, it hosts a pristine and diverse natural ecosystem that is unique in the world. The zone serves as home to many endangered plant and animal species, such as the Asiatic black bear.

The stages of the Korean War: back and forth movement of forces that resulted in the final truce line drawn near the 38th parallel, the line of latitude 38 degrees north of the equator (shown as a red dashed line).

## The Demilitarized Zone (DMZ)



Institute for Military History, Ministry of National Defence (2013)



Night-Time Satellite Image of Eastern Asia

Source: NASA

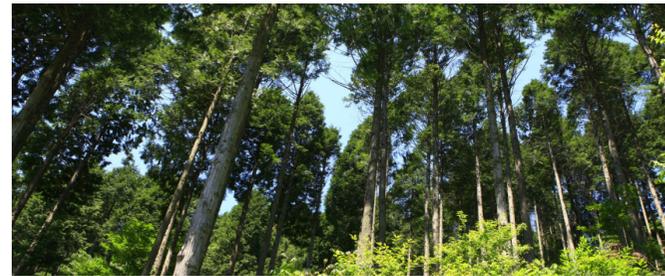
## Korea at Night

This satellite image shows the east Asia region at night as it appears from space. The white areas are well lit since they have more people, more buildings, and more electricity use. South Korea, Japan, and much of China are well-lit by street lights, buildings, houses, signs, automobiles, and manufacturing facilities. There are also many lights coming from certain areas in the oceans; these lights are from fishing vessels in search of squid, shrimp, or fish. The fishing boats combine to light up almost as much area as the cities on the mainland of South Korea.  
North Korea, in contrast, appears almost completely black. Only the capital city of North Korea, Pyongyang, appears as a small white blur. North Korea uses only

a fraction of the electricity that is used in South Korea, so there are many fewer lights. On average, a North Korean uses less than one-tenth of the electricity a South Korean uses. Ever since Korea's division into two countries, South Korea has grown from one of the poorest nations in the world to become an economic powerhouse. Many new buildings, factories, apartments, roads, and commercial areas have been built up as urban areas have expanded with the new economic growth. Meanwhile, North Korea has remained largely agricultural and has not had the same level of development. The satellite image of Korea at night vividly conveys the stark contrast in economic prosperity between the two Koreas.

# Landscapes and Scenery: Land Cover Classes

Remotely sensed imagery is often used to create land cover classification maps such as the one shown at right. Korea's beautiful scenery can be classified into five categories called land cover classes. Each class is mapped as a particular color on



the map to the right. The land cover map indicates general patterns of how land is used on different parts of the peninsula.

**Urban Areas:** Urban land (shown as red on the map) includes developed areas with, for example, commercial or industrial buildings, apartments, roads, airports, parking lots, or schools. Construction has mostly taken place in basins and along major rivers. Cities have gradually expanded with the growth of their populations. Roads and railways that connect cities have led to further development of new metropolitan centers in surrounding areas. Urban areas cover 2% of North Korea and 4% of South Korea.

**Forested Land:** Forests (shown as green on the map) are more common in mountainous regions and less populated areas on the eastern half of the Korean Peninsula. Forested areas have decreased as a result of urban and agricultural expansion. The fragmentation of forests has, in turn, threatened the livelihood of plants and animals living in the forest ecosystem. Because of this, efforts have been made to restore forests. Forests cover about 70% of the Korean Peninsula.

**Agricultural Land:** Farmlands (shown as yellow) for crop production and pastures for livestock animals have increased through the years. Hills were cultivated for farming upland fields, many of which have been converted into rice paddies using irrigation. Other crops grown in agricultural areas include ginseng, fruits, and vegetables. In coastal regions, some new farmland has been created by reclaiming land from the sea. Agricultural land covers 24% of North Korea and 20% of South Korea.

**Wetlands:** Wetlands (shown as purple) are low-lying areas that have water-logged soils or are frequently flooded with water. This class includes tidal flats that are covered with sea water at high tide. Also included are floodplains that are frequently flooded when streams go overbank. Wetlands are valuable animal and plant habitats and provide several ecological services, such as filtering contaminants from groundwater and helping to control flooding.

**Water:** Areas of water (shown as light blue) include lakes, artificial reservoirs, rivers, and the ocean. Although this class makes up a small percentage of land cover area, it is an important part of the environment. Water is used for drinking, irrigation, and industrial processes. Much effort has gone into ensuring a clean, safe, and consistent water supply for these uses.

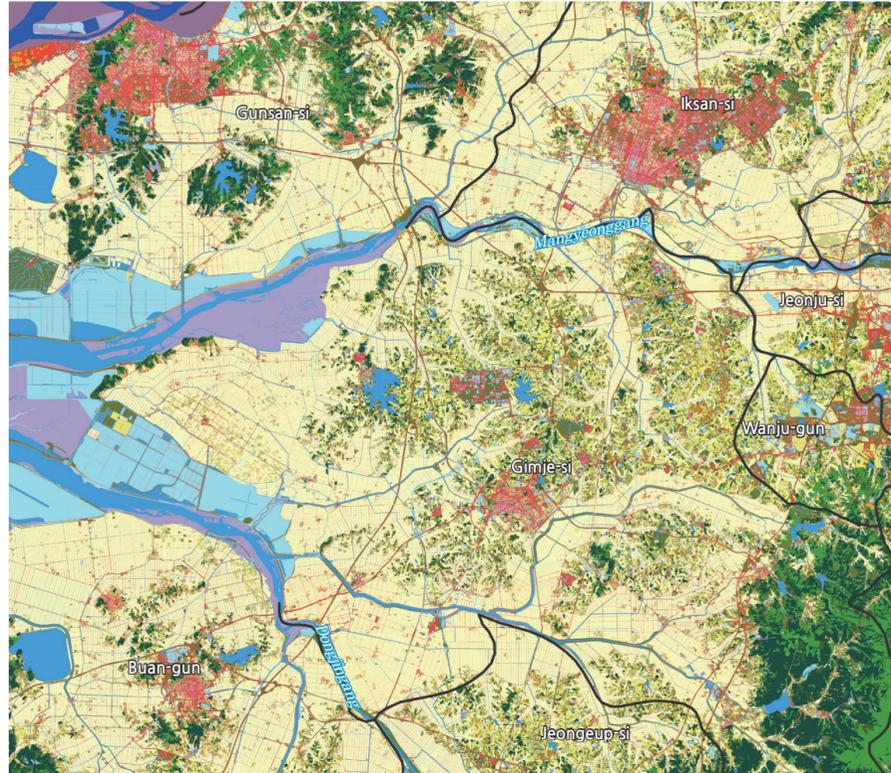
Land Cover Map of the Korean Peninsula



Ministry of Environment (2019)

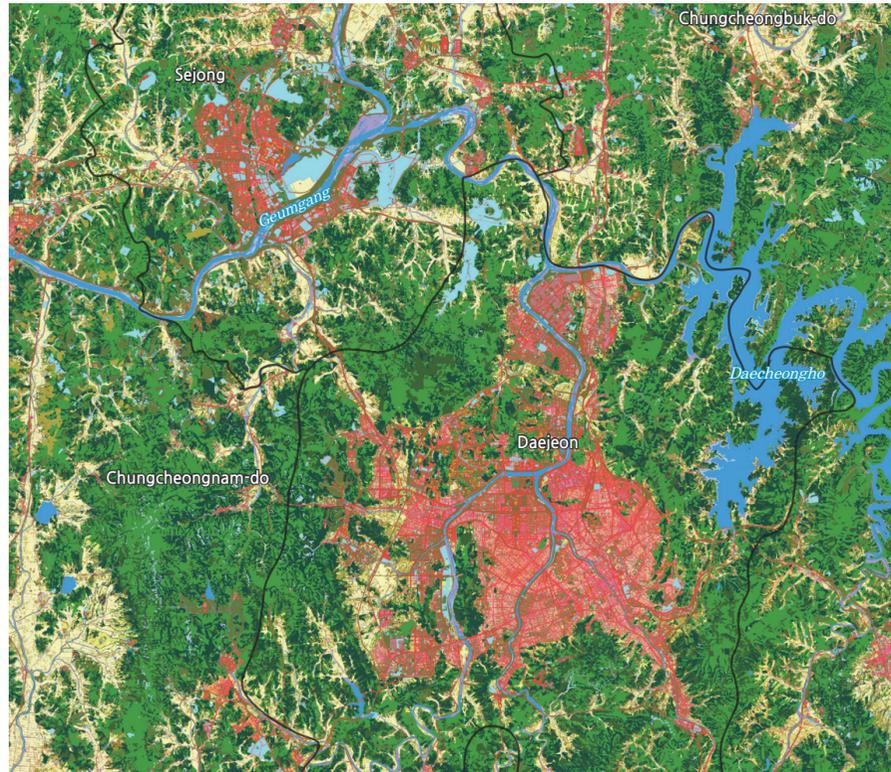
# Landscape Diversity

Plains Area



Ministry of Environment (2020)

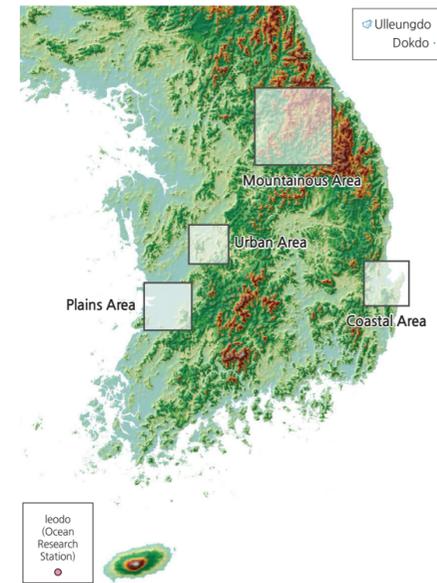
Urban Area



Ministry of Environment (2020)

The Ministry of Environment maintains a series of progressively detailed land cover maps to encourage effective land management and environmentally friendly land usage. The four mapped regions shown here are selected to represent the diversity of landscape and landcover patterns found across the Korean Peninsula.

**Plains:** Korea's major grain belts can be found across Mangyeongpyeongya and Gimjepyongya. 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 proportion of agricultural land out of all the 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.



**Urban areas:** Many cities such as Seoul, Chuncheon-si, Hongcheon-gun, Wonju-si, and Daejeon developed in erosional basins near large, flowing rivers. Owing to the availability of water from rivers and underground sources as well as their natural drainage systems, 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.

**Mountains:** 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 because of their clean mountains and creeks. Furthermore, high plantation surfaces located 1,000 m above sea level are widely used for vegetable fields and pastures.

Mountainous Area



Ministry of Environment (2020)

<b>Urban or Built-Up Land</b>	
Residential	Cultural
Industrial	Transportation
Commercial	Public Utilities
<b>Agricultural Land</b>	
Paddy Field	Orchard
Non-Irrigated Land	Other Cropland
Protected Cultivation	
<b>Forested Land</b>	
Deciduous Forest Land	Grassland
Coniferous Forest Land	Natural Grassland
Mixed Forest Land	Artificial Grassland
<b>Wetland</b>	
Inland Wetland (Wetland Vegetation)	Barren Land
Coastal Wetland	Natural Barren Land
	Artificial Barren Land
<b>Water</b>	
Inland Water	
Seawater	

Coastal Area

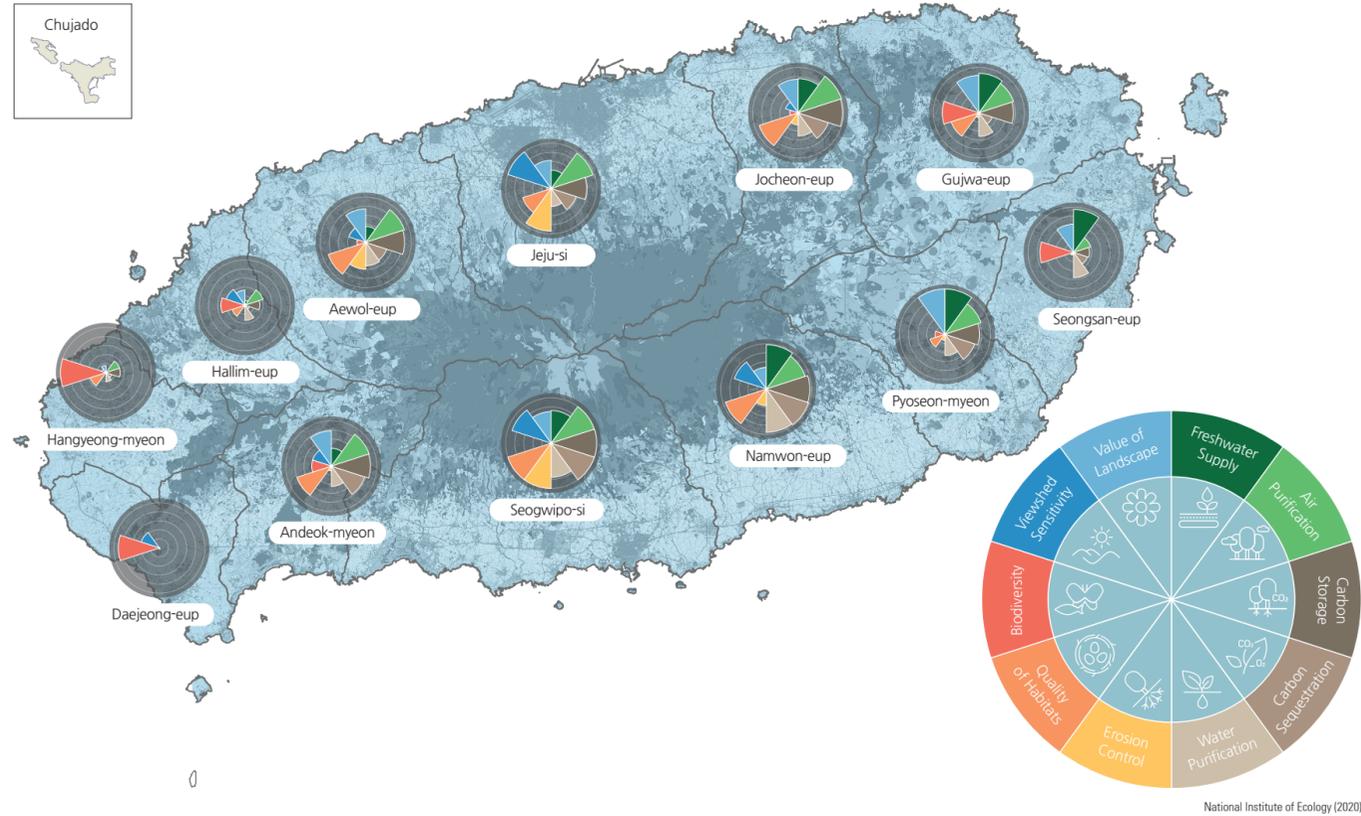


Ministry of Environment (2020)

**Coastal Area:** Taebaeksanmaek runs parallel to the east coast, resulting in narrow coastal plains and small-scale ports here. Wider plains can be found 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.

# Mapping a Sustainable Future

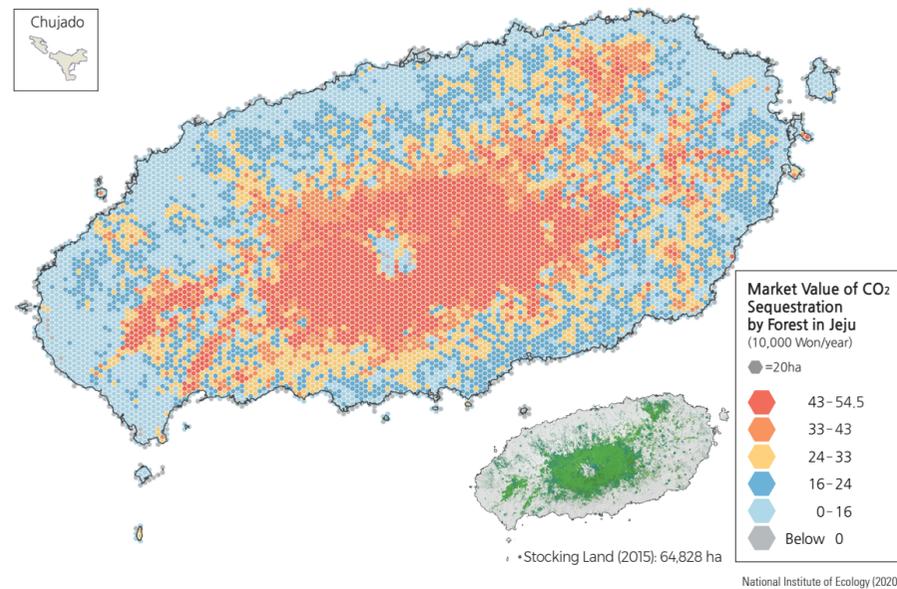
## Model-Based Assessment of Ecosystem Services in Jeju



In 2018, the Ministry of Environment in Korea initiated a project to map ecosystem service assessments at the local government level. This project resulted in the production of ecosystem services maps of Jeju Island in 2019. This project serves as an inspirational model for how modern geospatial and mapping technologies can be used to support land management and stewardship efforts. It has also proven to be a successful endeavor due to its collaborative, community-based approach that involves local residents.

Ecosystem services are the benefits derived from ecosystems essential for human well-being. These services are states or processes that allow ecosystems and biological species to support human systems. According to the Millennium Ecosystem Assessment (MEA) in 2005, 60% of the world's ecosystem services are currently degraded.

## Market Value of CO<sub>2</sub> Sequestration by Forest in Jeju



This is a pressing issue that requires collaborative scientific research and collective action to address the sustainability of these services.

The MEA report brought attention to the relationship between humans and ecosystem change, as well as the quantifiable and comprehensive loss of ecosystem services. These services can be divided into four categories: provisioning services, which refer to benefits that humans receive directly from the ecosystem (e.g., food, water, and wood resources); regulating services, which are benefits generated by the regulation of ecosystem processes (e.g., air and water quality control, climate regulation, erosion control, pollination); cultural services, which include leisure and recreation, spiritual inspiration from nature, and education; and supporting services, which provide essential and basic services such as biodiversity and soil formation.

The mapping and monitoring of ecosystem services provide valuable management tools. And the dynamic and inclusive approach encourages community involvement, helping to spread awareness about the benefits of the natural world that are often unappreciated. By valuing and promoting the sustainable use of ecosystem services, projects such as this one demonstrated at Jeju Island can improve the quality of life for current and future generations.

## Ecosystem Service Maps Created by Collaboration with Local Residents

