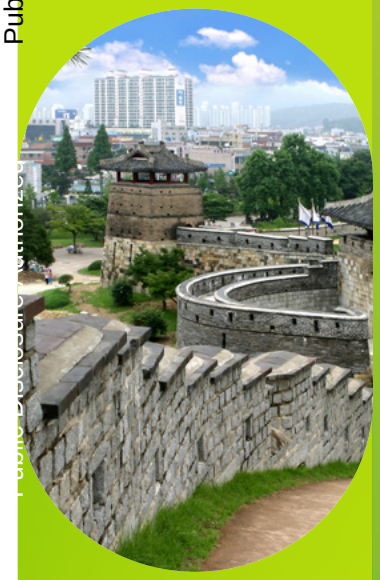
Cities, Culture and Climate Change



Learning from the **Republic of Korea**'s Experience

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KRIHS
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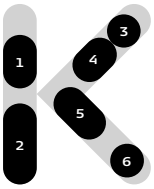

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Acknowledgements

This report is the result of a collaboration between the World Bank and the Korea Research Institute for Human Settlements (KRIHS), under the guidance of Bernice Van Bronkhorst and Sang Keon Lee. The team was co-led by Ahmed Eiweida and Youn Hee Jeong and included Guido Licciardi, Minjee Kim, Sohaib Athar, Diana Tatucu, Cheonjae Lee, and Jiyeon Lee.

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Foreword

We are delighted to present this report as a joint work of the Korea Research Institute for Human Settlements (KRIHS) and the World Bank. We are pleased to notice how the Republic of Korea, an economic development aid recipient less than two decades ago, has become a donor, with an increasingly coherent and coordinated strategy that leverages the country's expertise and makes aid available to developing countries worldwide to help them advance along the development path.

This report demonstrates the leading development role that Korea can play globally and provides practical insights into how cultural heritage and sustainable tourism (CHST) can help combat climate change and its impacts. The report discusses challenges and opportunities of climate action in CHST, presenting good practices and case studies from Korea and exploring their replicability in developing countries. Good practices are presented from different areas, beginning with Korea's national policy, where the regulatory side of climate action is discussed, continuing with concrete case studies of three cities and destinations and that cover some of the main pillars of culture and tourism: a large city (Seoul), a secondary city of cultural heritage significance (Suwon), and a major tourism destination with predominantly natural heritage and coastal attractions (Jeju Island). Based on analysis and reviews or other global cases and literature, the report presents operational guidance and a proposed framework for cities and national policy makers on the contribution of CHST to climate action to help meet Sustainable Development Goal (SDG) 11 ("Sustainable Cities and Communities") and SDG 13 ("Climate Action").

As the report points out, the CHST sector is highly vulnerable to climate change and at the same time contributes significantly (about 10%) to greenhouse gas (GHG) emissions. Emissions from tourism are forecasted to increase by 25% by 2030 from 2016 levels, against the current ambition scenario. Furthermore, annual damage to cultural heritage assets and endowment due to climate change forces is increasing. Accelerating climate action in CHST for both adaptation and mitigation is, therefore, of utmost importance for the resilience of the sector and its contribution to international net-zero commitments. The need to scale-up climate action in CHST remains urgent; ultimately, the cost of inaction with regards to climate change will be, in the long run, larger than the cost of any other crisis. There is a growing consensus among CHST stakeholders as to how future resilience will depend on the sector's ability to embrace a low-carbon pathway and cut emissions by 50% by 2030.

The report begins by outlining the challenges and presenting a proposed global framework, anchored in literature review and expert roundtable discussions. The global framework is then tailored to Korea, expanding on the deep linkages between Korean cities and climate change in the CHST sector. Firm policies deployed by the Korean Government in support of climate action in the CHST sector are then presented, illustrating how the country has been pioneering innovative approaches to reduce carbon emissions while enhancing the resilience of its cultural and natural heritage endowment. Among the good climate action practices that Korea offers, the report focuses on:

1. Seoul, a leading world capital that has recently become a benchmark for low-carbon urban development, with innovative solutions to enhance its tourism attractiveness while reducing the carbon footprint of the industry.

2. Suwon, a secondary city of historic significance that has been incorporating sustainable tourism into its economic diversification strategy, introducing some successful measures and incentive-based mechanisms to strengthen industry sustainability.

3. Jeju island, a small destination that has placed sustainability at the core of its offering, with a robust strategy aimed at reducing the carbon footprint of tourism, an industry that is essential to creating jobs for local communities.

The report can inform policy makers in the developing world and inspire their choices to replicate Korea's success. With the practical examples presented here, policy makers can learn about adaptation and mitigation measures in CHST anchored in a proposed framework structured around three pillars: 1) institutional and policy change, 2) behavioral change, and 3) climate action for a green circular economy. While the Korean case studies can provide

valuable insights, it is essential to recognize that they represent only a part of the larger picture of the country's experience as well as the framework addressed here. We hope that the challenges and opportunities presented can support decision-makers in developing countries, particularly those with a fast-growing tourism industry, where ensuring sustainable growth while pursuing industry resilience is essential.

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Abbreviations

Abbreviation	*Definition*
AI	Artificial Intelligence
BUA	Business as usual
CC	Climate change
CFD	Carbon Footprint of Products
CFI	Carbon Footprint Island
CHA	Cultural Heritage Administration
CHST	Cultural heritage and sustainable tourism sector
DRM	Disaster risk management
EPD	Environmental Product Definition
ESG	Environmental, social and governance
FI	Festival identity
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse gas
GRDP	Gross regional domestic product
GW	Gigawatts
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
ICOMOS	International Council on Monuments and Sites
IPCC	Intergovernmental Panel on Climate Change
KEI	Korea Environment Institute
KRIHS	Korea Research Institute for Human Settlements
LED	Light-emitting diode
MCST	Ministry of Culture, Sports and Tourism
ME	Ministry of Environment
MIC	Middle-income country
MLIT	Ministry of Land, Infrastructure and Transport
MTIE	Ministry of Trade, Industry and Energy
MW	Megawatts
NASA	National Aeronautics and Space Administration
NDC	Nationally Determined Contribution
NGO	Non-governmental organization
NRICH	National Research Institute of Cultural Heritage
ODA	Overseas development assistance
OUV	Outstanding Universal Value
PET	Polyethylene terephthalate
PP	Polypropylene
REC	Renewable Energy Supply Certificate
SAF	Sustainable aviation fuel
SWOT	Strengths, weaknesses, opportunities, and threats
TALC	Tourism Area Life Cycle
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCO	United Nations Education, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNWTO	United Nations World Tourism Organization
WHS	World Heritage Site

Wolhwawon garden, Paldal-gu, Suwon – Janis Rozenfelds on Unsplash.com

CHAPTER 1

Introduction

The results of comprehensive research on cultural heritage and sustainable tourism sector (CHST) and climate change

THE WORLD BANK AND THE KOREA RESEARCH INSTITUTE FOR HUMAN SETTLEMENTS (KRIHS)

Introduction

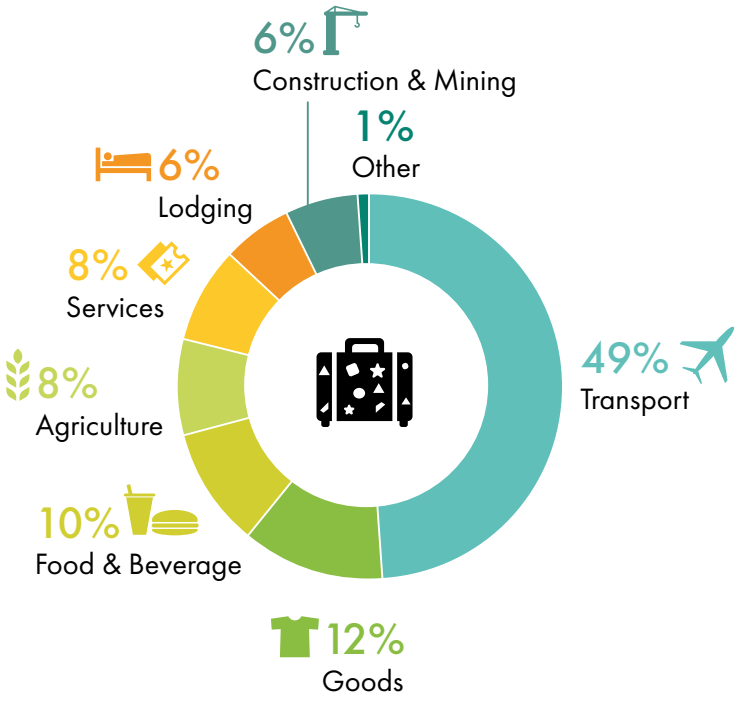
This report presents the results of comprehensive research on cultural heritage and sustainable tourism sector (CHST) and climate change, carried out in partnership between the World Bank and the Korea Research Institute for Human Settlements (KRIHS). The report focuses on the climate-change impact on heritage sites and tourism destinations, documenting good adaptation practices, and explores the sector's contribution to climate action and mitigation strategies. The report analyzes case studies from Republic of Korea and documents the ways the country has incorporated climate actions into policies to enhance sustainability and resilience. Effective practices are presented from different areas, beginning with Korea's national policy infrastructure, where the regulatory side of climate action is presented, and continues with concrete case studies that cover some of the main pillars of culture and tourism; that is, a large city (Seoul), a secondary city of cultural heritage significance (Suwon), and a major tourism destination with predominantly natural heritage and coastal attractions (Jeju Island). Based on analysis and reviews of other global cases and literature, the report presents operational guidance and a proposed framework for cities and national policy makers on the contribution of cultural heritage and sustainable tourism to climate action and thus meeting Sustainable Development Goal (SDG) 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action) targets.

Findings presented in the report corroborate a well-established body of literature on CHST contribution to climate change. From an economic standpoint, the study confirms that tourism is one of the world's largest industries, accounting for some 9% of global GDP and generating more than US$ 6 trillion in revenue each year. Tourism provides livelihoods to more than 250 million people worldwide. While the sector was heavily impacted by the COVID-19 pandemic, particularly due to travel restrictions, it also showed a remarkable degree of resilience, with a fast recovery that has been visible in all destinations as travels resumed. Tourism, especially culture- and nature-based tourism, is particularly important for some of the world's poorest and middle-income countries (MICs), especially some resource-scarce countries and small islands, where it is an essential source of export and job creation, especially for women and youth. The report presents how tourism is responsible for about 8% of the world's carbon emissions, which is a high share for a single industry. Various activities contribute to tourism's carbon footprint, particularly travel, at 49% (mainly for aviation), followed by goods production (12%), food (10%), and, with a significant contribution from lodging (6%)(Figure 1.1). As the number of people who can afford to travel grows along with the global increase in the middle class, tourism's environmental footprint has been increasing, which calls for immediate climate actions. Under a business-as-usual scenario, the sector's emissions are forecasted to grow by 130% by 2035 (compared to the 2005 baseline), while emissions from aviation and lodging are projected to triple.

There are considerable impacts that tourism is facing due to climate change. It is well understood that tourism is a main contributor to climate change, and that the sector faces profound impacts from climate change—impacts that are already being felt on 1) the very assets that tourism is based on, which are disproportionally affected by climate change due to their intrinsic fragility and vulnerability, and 2) industry operations, which are affected by climate change in several dimensions.

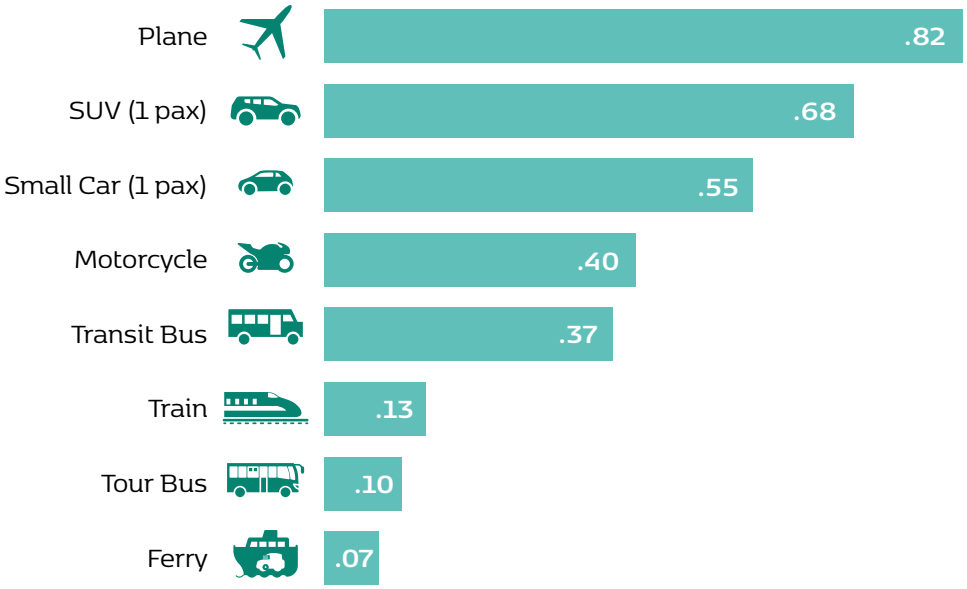
1. ***Impacts on tourism assets.*** As temperatures rise, the attractiveness of many destinations begins to fade, and several cultural and natural heritage sites have already been significantly affected. Winter sports have become less viable in a number of locations. Coastal tourism infrastructure is highly vulnerable to rising sea levels and extreme weather and thousands of beaches have eroded or become submerged. The natural features that millions of tourists travel to enjoy have already started to degrade or have been destroyed altogether. Further, ocean acidification and rising sea temperatures have

Figure 1.1 Share of tourism industry's carbon emissions, by domain



Source: Sustainable Travel International.

Figure 1.2 Share of travel sector's carbon emissions, by mode of transportation



Source: Sustainable Travel International.

started degrading and destroying coral reefs. Rising temperatures have already reduced the viability of nature-based tourism, damaging biodiversity and leading to more forest fires on mountains and remote natural areas. Cultural heritage sites have been affected, too, with many of them suffering exacerbated decay, in some cases leading to their outright loss.

2 ***Impacts on tourism operations.*** The most apparent climate-change impact on the tourism sector operation is reduced water availability, which has often led to disputes with local industry and communities. Other operational impacts include uncertainty due to extreme weather events, particularly in poorer countries, as well as decline in insurability in areas exposed to extreme weather or sea-level rise. Lastly, efforts to cut emissions may add costs to the sector, particularly from transport emissions, where another challenge is that potential gains in emissions from energy and fuel efficiency can be easily offset by robust sector growth.

Cultural and natural heritage sites are essential components of the tourism sector and are heavily impacted by climate change. Heritage and climate change have a dual relationship. Traditionally, cultural management and conservation have focused on maintaining and conserving the physical condition and fabric of cultural assets so that they could be leveraged for tourism. Over the past few decades, however, there has been a shift from material-focused conservation towards integration of heritage in development, together with an increasing body of knowledge and research on linking culture with broader development challenges, particularly tourism. The interplay between cultural heritage and climate change has become a subject of attention for researchers, decision-makers, and policy makers for two main reasons: 1) negative impacts caused by climate change on heritage assets, and 2) heritage assets as source of traditional knowledge on adaptation to and mitigation of climate change.

1 ***Negative impacts caused by climate change on heritage assets***. A consolidated approach to heritage and climate change should focus on negative impacts, highlighting that heritage assets have always been and will continue to be impacted by their natural environment, often referred to as "weathering processes", and thus to change. Gradual changes in temperature, precipitation, atmospheric moisture, and wind intensity, as well as sea level rise and changes in the occurrence of extreme events, have always affected heritage assets, and signs of change are some of their most fascinating intrinsic features. However, the recent increase in intensity of climate events and the subsequent exacerbated consequences of such increased exposure has worsened these negative impacts. Climate change continues to affect more and more cultural and natural heritage sites, including World Heritage Sites (WHSs). It has now become one of the most prevalent threats to these unique places. Climate change is associated with increasing frequency and severity of meteorological and related events, such as, storms, floods, droughts, and fires. At many sites, increasing impacts associated with climate change—either short-term impacts due to imminent events such as hurricanes or flash floods, or long-term impacts due to the cumulative negative effects and degradation, such as coastal erosion or drought—have resulted in structural damage (for example, in Chan Chan and Chavin archaeological sites in Peru), conservation deteriorations (for example, in Timbuktu, Mali), and even irreplaceable losses (for example, Roman site of Troia in Portugal). Recent developments in geospatial information technology, globally and in particularly Korea, have prompted policy makers to utilize geospatial information for decision-making in managing disaster-risk situations. Likewise, technology can be useful in understanding and assessing climate-change impacts in cities and cultural heritage sites.

2 ***Heritage assets as sources of traditional knowledge on climate-change adaptation and mitigation.*** Heritage assets, on the other hand, can convey traditional knowledge that builds resilience for change and leads us to a more sustainable future. A number of inspirational and effective climate actions have been implemented at heritage sites—for instance, urban density (such as cities in Yemen) to reduce energy and transport needs, or the use of greenery to reduce heat islands in cities (for example, Paris boulevards). Additional examples include the use of sustainable building techniques that ensure resilience and at the same limit energy necessary for construction (for example, mud bricks in Africa or Latin America or seismic resilient wooden architecture in Afghanistan). Natural heritage sites can offer unique ways to address climate-change, such as traditional approaches to save water in agriculture (for example, rainwater harvesting in the Middle East) or promote circular approaches to water management (for example, Petra and its valley in Jordan).

Climate-change adaptation and mitigation in CHST should be anchored by a tested framework. The report proposes a framework structured around three pillars: 1) institutional and policy change, 2) behavioral change, and 3) climate action for green circular economy.

Figure 1.3 Framework for climate-change adaptation and mitigation in CHST

Source: Original figure for this publication.

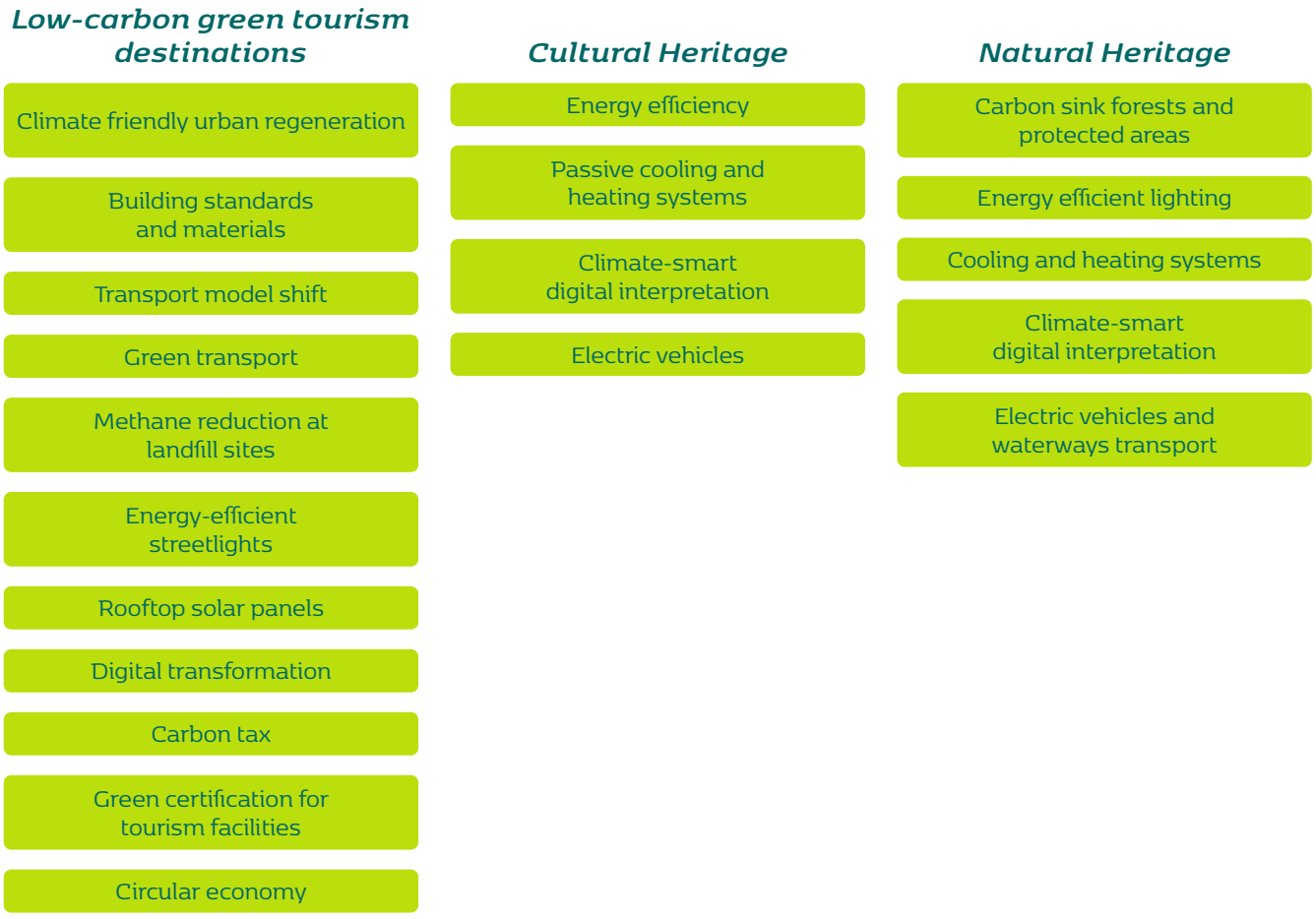
The objective of this three-pillar approach is to promote a tourism model that reduces the sector's carbon footprint. People tend to travel for a fixed number of days in a given year, whether for holidays or business, and how they spend these days in the face of climate change is key. They can either spend their time traveling extensively by planes and polluting cars, with short stays in multiple destinations and thus increasing their carbon footprint dramatically; or, they can do so following a model that can be defined as "slow tourism", where holidays are spent with longer stays in fewer places, appreciating local culture, choosing food that has travelled a smaller distance between farm and fork, thus helping to mitigate climate change, and getting in touch with local communities. This, is turn, reduces the number of times people would take flights and cars, ensuring a low-carbon, greener tourism model.

Figure 1.4 Three key aspects of a low-carbon tourism model

Source: Original figure for this publication.

There is growing awareness of the positive impacts of this nascent approach; however, for this style of tourism to grow, it is essential to invest in strong institutions and policies that can establish a foundation for "slow tourism", supporting businesses and destinations that make a deliberate shift in support of this approach. Similarly, this model requires a behavioral change in the tourists themselves, encouraging an increased awareness and appreciation for local culture and a travel modality that privileges experience over speed. Lastly, a number of specific climate actions are required, regarding destination management as well as the promotion, operation, and maintenance of cultural and natural heritage sites. Figure 1.5 presents a summary of these actions.

Figure 1.5 Climate actions to support slow tourism in CHST

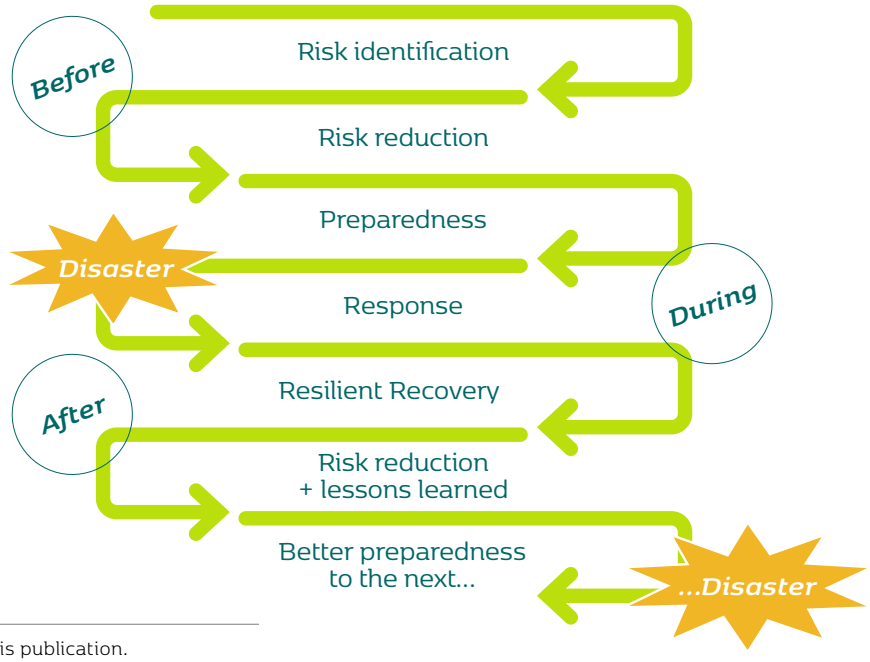


Source: Original figure for this publication.

Climate-change adaptation in CHST is multifaceted, based on stakeholder and sector offerings. The dynamic nature of tourism and its ability to cope with a range of recent major shocks, including the fast recovery after the recent COVID-19 pandemic, suggests a relatively high adaptive capacity within the sector overall. However, in examining more deeply the various components of tourism, the capacity to adapt to climate change varies substantially between stakeholders, destinations, products, and individual businesses. For example, as consumers, tourists have the greatest adaptive capacity, based on three key resources that they own: money, knowledge, and time. Tourists have relative freedom to avoid destinations impacted by climate change or to shift the timing of travel to avoid unfavorable climate conditions. The situation for suppliers of tourism services and tourism operators at specific destinations is more diverse, as they have less adaptive capacity and a lower degree of resilience. Large tour operators, who do not own tourism infrastructure, are in a better position to adapt to changes at destinations because they can respond to client demands and provide information to influence clients' travel choices, and then shift their preferences and offerings accordingly. However, tourism operators with large investments in immobile capital assets (for example, hotels, housing, resort complex, marinas, or attractions) have the least adaptive capacity due to non-movability of their invested capital. There is also, at the other end of the spectrum, an aspect often overlooked in the research. Tourism is one of the few industries that is experiencing a climate-change adaptation angle, with new offerings actually emerging from climate change. For instance, higher temperatures have made new regions more attractive to some tourists, creating opportunities for new types of tourism.

As climate-change related natural hazards are clearly increasing in frequency and intensity worldwide, affecting the poorest and most fragile countries more severely than other countries, integrating disaster-risk management (DRM) and cultural heritage is fundamental to foster climate-change adaptation in historic cities as well as cultural and natural heritage sites. In recent decades, some international organizations and academic institutions have developed tools and methodologies to facilitate this integration, which can be applied to climate-change projects.

Figure 1.6 Disaster-risk management (DRM) phases and activities



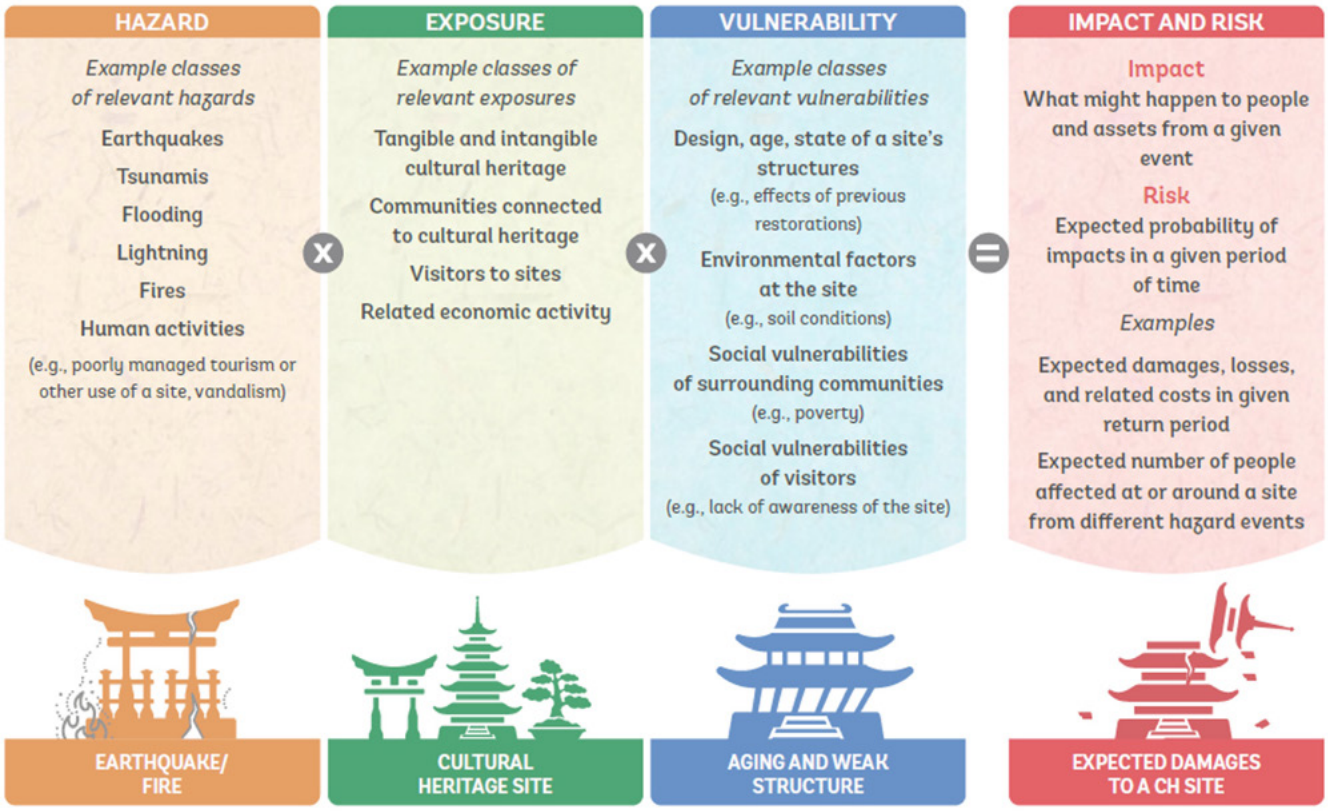
Source: Original figure for this publication.

DRM efforts can be broadly divided into three phases: before, during, and after hazardous events happen (Figure 1.6). Initially represented in visual terms as a circle, this idea was later imbued with the concept of resilient recovery—following the principle of *building back better*—since at the end of the final DRM phase the status of cultural heritage sites should include risk-reduction measures that increase resilience and preparedness for potential future disasters. Therefore, culture and cultural heritage should be considered in all DRM phases, from risk identification and assessment to risk reduction, emergency preparedness and response, and resilient recovery.

One of the key references for DRM is the *Sendai Framework for Disaster Risk Reduction 2015-2030,*[1] which established the role of culture as a component of DRM, an unprecedented step, and explicitly acknowledged that inequality and poverty are direct drivers of vulnerability. In particular, the framework calls for 1) integration of a cultural perspective in policies and practices; 2) understanding of the impacts on cultural heritage when specific hazard events occur, as well as better identification of risks to cultural heritage before disasters occur; 3) protection of cultural institutions and other sites of historical, cultural heritage, and religious interest; and 4) complementing scientific knowledge with traditional, indigenous, and local knowledge and practices in disaster-risk assessment.[2]

Other key references and tools that contribute to the integration of DRM and culture include: *Disaster Risk Management of Cultural Heritage in Urban Areas Training Guide*, developed by the Institute of Disaster Mitigation for Urban Cultural Heritage at Ritsumeikan University in Kyoto, Japan;[3] *Handbook and Toolkit for First Aid and Resilience to Cultural Heritage in Times of Crisis*, developed by the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM);[4] and the United Nations Office for Disaster Risk Reduction's (UNDRR) *Disaster Resilience Scorecard for Cities: Cultural Heritage Addendum*.[5] One notable case study, a compilation of lessons learned from the Japanese experience on this topic, was developed by the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR): *Resilient Cultural Heritage: Learning from the Japanese Experience* (Figure 1.7).[6]

Figure 1.7 Framework for disaster-risk calculation for cultural heritage sites



Source: World Bank and the GFDRR, *Resilient Cultural Heritage: Learning from the Japanese Experience,* 2020.

More specifically related to climate change, the International Council on Monuments and Sites (ICOMOS) has published several resources, including the *Future of Our Pasts: Engaging Cultural Heritage in Climate Action* report[7] and the *Climate Change Adaptation Guide*.[8] In addition, the ICCROM is developing the *Net Zero: Heritage for Climate Action* program,[9] which is currently under implementation (2022-2023). Conceived as a multi-level capacity-development initiative, the program seeks to develop and implement heritage-based mitigation and adaptation strategies on site through pilot projects in five risk-prone countries to reduce the impacts of climate change for both people and heritage. This innovative program was created under the *Climate. Culture.Peace* framework,[10] which was presented at an international conference held January 2022 that examined the connections between heritage, disaster-risk reduction, peacebuilding, and climate action.

Building on these case studies and resources, there are some key considerations that should be taken into account when connecting DRM to cultural and natural heritage in the face of climate change. These include how climate change affects the water cycle—causing changes in the frequency, intensity, and timing of precipitation—as well as melting glaciers, sea level rise (saltwater infiltrating freshwater), and warmer temperatures affecting aquatic ecosystems and other natural habitats.

Likewise, it is important to note that global weather phenomena such as El Niño impact different regions in different and sometimes opposite ways. For example, while during an El Niño year the hurricane season is more devastating in the Americas, there can be simultaneously an incremental increase in severity

of the drought season in Africa, but a less severe monsoon in India. Different regions of the planet are all connected by these phenomena.

In conclusion, climate-risk assessments are fundamental to better understand potential future scenarios where cultural and natural sites are affected by climate change, to develop and implement effective adaptation and mitigation strategies and to make informed decisions and investments. In this regard, it is critical to ensure a holistic approach, integrating DRM principles to ensure that a wide variety of hazards in the specific area are taken into consideration and subject to analysis. It is well understood that hazards are inter-related; thus, a multi-hazard approach is optimal.

This could only be possible if there is an integration of top-down and bottom-up approaches—that is, starting from global climate assessments and downscaling, using regional models to identify the specific impacts for each region. Therefore, international collaboration, fostering learning exchanges on climate assessments and the use of DRM methodologies and tools, as well as potential replication of informative case studies—such as the examples from Korea described in this report—are key to enhancing resilient cultural heritage in the face of climate change.

Climate-change mitigation in CHST is of key importance and demands urgent climate actions. Climate-change mitigation relates to technological, economic, and socio-cultural changes that can lead to reductions in GHG emissions. Tourism-related emissions are projected to continue to grow rapidly under "business-as-usual" conditions, in contrast to the substantial emission reduction targets to which the international community has agreed. Since specific emission reductions required for tourism to contribute meaningfully to broader, cross-sector reduction targets set by the international community are substantial, mitigation should, ideally, combine various voluntary economic and regulatory strategies. These strategies can be targeted to different stakeholder groups, including tourists, tour operators, lodging companies, airlines, manufacturers of cars and planes, as well as managers of destinations and cultural and natural heritage sites. These tools could also be applied differently in different countries, so as not to jeopardize the development and poverty reduction opportunities that tourism brings to many developing countries.

Climate-change mitigation strategies to reduce emissions in tourism can be grouped into four pillars. Mitigation refers to efforts to reduce or prevent greenhouse gas (GHG) emissions. Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behavior. Protecting natural carbon sinks like forests and oceans or creating new carbon sinks are also elements of mitigation. In the tourism sector, mitigation can be achieved by reducing energy use, through changing travel behavior, by improving energy efficiency, increasing the use of renewable energy, carbon offsetting strategies, sustainable destination planning and management, influencing tour operators' choice of destinations and packaging of travel products, as well as other changes in business practices. To summarize, mitigation strategies in tourism can be structured around four pillars: 1) reducing energy use, 2) improving energy efficiency, 3) increasing use of renewable energy, and 4) sequestering carbon through sinks.

1 ***Reducing energy use.*** Reducing energy use is perhaps the most essential pillar of climate-change mitigation for tourism and can be achieved in a variety of ways: by changing destination development and marketing (for tour operators) or destination choices (for tourists), as well by promoting shifts in transport use from car and aircraft to rail and coach and supporting less transportation time and promoting longer destination stays. Changing management practices can also be of great importance for business tourism. Tour operators can play a key role in this process—as they bundle products into packages that are advertised to and purchased by tourists—by supporting less frequent travels within the same trip. Tour operators can also increase lengths of stay, which would very effectively reduce the carbon footprint per tourist day and increase economic opportunities for destinations. However, current tourism trends show an increase in short stays, which is undermining efforts to enhance sector sustainability and

resilience. Reduced cost of transportation and faster transportation options are contributing to shorter stays and more frequent travels within the same trip. Here is where tour operators have considerable influence: in creating demand for less carbon-intensive journeys by creating attractive products that meet tourists' needs and desires. Regarding aviation, the highest contributing element to carbon emissions in tourism, the sector seems to favor emissions trading over the taxation of fuel or emissions. An even better alternative might be to create an emissions trading scheme entirely for aviation. More efficient technologies could be introduced, too, enabling the profitability of the aviation sector to grow rapidly, as prices for tickets can be increased while operating costs remain stable.

2 ***Improving energy efficiency.*** This pillar can be an effective mechanism to decrease energy demand in tourism. For example, new technologies can significantly reduce the emissions of aviation in a business-as-usual scenario, simply because they save fuel costs and improve aircraft performance. Reductions in emissions are likely to be on the order of 32% until 2035. Additional efforts to bring aviation technology to the theoretical limit (50% reduction of emissions between 2005 and 2035) would contribute to an overall reduction of total emissions from travel (excluding same-day, including all transport modes) by 14% compared to the business-as-usual scenario. New technologies for car transport have the potential to reduce 7% of all tourist emissions. The same overall emissions reduction (14%) may be achieved with strong reductions in lodging. However, the introduction of new air transport technologies can take a long time as the market introduction of new technologies is slow and because of fleet renewal stretches over several decades due to the long operational life of aircraft. The more rapid introduction of new technologies is thus dependent on environmentally pro-active management decisions, such as emissions trading, that need to be aided by government policy. However, these gains can be easily eroded by a sharp increase in tourism demand, which has been observed in recent years.

3 ***Increasing the use of renewable energy.*** Research shows that virtually all sources of renewable energy are relevant for tourism, including wind, photovoltaic, solar thermal, geothermal, biomass, and energy regeneration from waste. Several studies have explored the extent to which renewable energy sources can be used for tourism, in particular at cultural and natural heritage sites and island destinations where fossil-fuel energy is expensive and at risk of supply interruptions. These studies conclude that the use of renewable energy sources is generally economical and technically feasible. For example, in a vast number of destinations in the tropics, investments in solar energy can pay off in as little as two years. Biofuels are another option to contribute to more sustainable transport systems, even though several problems remain unsolved, particularly relating to the sustainability and efficiency of biofuel production and increasing competition over land, especially arable land areas. It should also be noted that the maximum share of biofuels for use in transport is estimated at less than 10%.

4 ***Sequestering carbon through sinks.*** GHGs can also be stored in biomass (for example, through afforestation and avoided deforestation), in aquifers or oceans, and in geological sinks (for example, depleted gas fields). Carbon sequestration in tourism is currently practiced through carbon compensation or carbon offsetting, which means that an amount of emissions equal to that caused by a certain activity (such as an airline flight) can be reduced elsewhere (through the planting of additional trees, for example). There is still some lack of clarity among tourists about what carbon offsetting is, and there is also evidence that particularly hyper-mobile tourists, who account for the major share of the distances travelled and emissions caused, are not ready to support voluntary carbon offsets. There is also a risk that carbon offsetting, which has been initiated as a voluntary form of carbon reduction, will be

used by the industry to claim that tourism has reduced emissions. This effectively means that producer responsibility is turned into customer responsibility, which may be problematic if there is no action by industry to reduce fuel use. As such, carbon offsetting is seen as a controversial climate-action solution, because it potentially diverts from the real causes, bypassing the structural, behavioral, and technological changes that need to be made to achieve long-term GHG reductions in the tourism sector. Nevertheless, research is clear in highlighting that carbon offsetting does have a role to play in mitigation efforts in tourism.

The Korean experience offers good practices on CHST's contribution to climate action, including effective adaptation and mitigation policies and investments. This report features in the first chapter the **national policy context for CHST and climate change in the Republic of Korea**, illustrating how the country has been pioneering innovative approaches to reducing emissions, while pursuing sustainable destination management. This first chapter is important for developing countries, as they can explore regulatory mechanisms to enhance resilience of tourism and support the introduction of climate actions to promote adaptation and mitigation strategies in their tourism destinations. Subsequent chapters present a series of compelling case studies, which are representative of the three main offerings of tourism.

The first case study features **Seoul**, a leading world capital that has recently became a benchmark for low-carbon urban development, with innovative solutions to enhance its tourism attractiveness while reducing the carbon footprint of the industry. Urban tourism is a fast-growing offering in the sector and the relevance of Seoul for other urban tourism destinations globally is high, especially considering its rapid development and bold commitment to climate action.

The second case study is **Suwon**, a secondary city of cultural heritage significance that has been developing sustainable tourism within its economic diversification strategy, introducing some successful measures and incentive-based mechanisms to strengthen sustainability. This case is of particular importance for enhancing tourism sustainability and resilience: developing secondary destinations close to main destinations can help reduce the need to travel extensively within the same trip and help extend the average length of stay, leveraging local heritage, local crafts, and local food production. A case like Suwon shows the positive externalities of reducing emissions through reduced travel while promoting higher spending in wider geographical areas, which spreads benefits for local communities.

The third case study presents **Jeju Island**, an emblematic case of a small-island destination endowed with remarkable natural heritage. Jeju has placed sustainability at the core of its tourism offering, with a robust strategy aimed at reducing the carbon footprint of coastal and natural tourism, which are both essential to create jobs for local communities. This third case offers interesting insights with a high degree of replicability, particularly for developing countries, due to the simplicity of its solutions and their bottom-up approach that involves local communities.

While the Korean case studies can provide valuable insights, it is essential to recognize that they represent only a part of the larger picture of a country's experience and the framework addressed here. The institutions and authors of this report hope that the challenges and opportunities presented can support decision-makers in developing countries, particularly those with a fast-growing tourism industry, where ensuring sustainable growth while pursuing industry resilience is essential.

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CHAPTER 2

Vision, Progress, and the Future

Tourism and Heritage Policy on Climate Change Responses in Korea

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Introduction

Carbon emissions from tourism are increasing significantly. The contribution of tourism to global carbon emissions was calculated to be 4.9% in 2005,[1] increasing to approximately 8% in 2013,[2] and it is expected to become even larger in the future, rendering tourism a potentially potent contributor to CC. Since carbon emissions in Korea are expected to follow similar trends, the government has embarked on efforts to accurately calculate carbon emissions of the tourism sector. Korea is the 14th country to legislate the 2050 Carbon Neutrality vision, prompting the Government of Korea government to begin responding to CC in the tourism and heritage sectors. Stakeholders in the tourism sector have been identifying countermeasures against CC since 2008, and heritage sectors started to implement measures to protect heritage assets vulnerable to CC since 2016. To better understand the current status of Korea's CC response in tourism and heritage at the national and local government levels, as well as by the private sector, it is necessary to first examine more closely Korea's legal system in the context of climate change and how national policies are being implemented accordingly.

This chapter focuses on the national context of tourism and heritage policies that address CC. It covers the role of Korea's national government in various CC actions in tourism and heritage related to 1) adaptation, reducing impacts of CC on tourism and heritage; and 2) mitigation, looking at tourism and heritage as source of knowledge for greenhouse gas (GHG) emission reduction.

There are a number of key characteristics of government policies that address CC and are currently under implementation. First, CC response national policies have been prepared using a top-down approach led by the government, yet CC adaptation and mitigation policies are uneven and lack a central department to manage them. Adaptation methods in Korean tourism and heritage include monitoring and follow-up measures, development of advanced detection and diagnosis technologies, development of vulnerability tools and databases, and awareness-raising campaigns on the need to cope with CC. Mitigation measures include carbon reduction systems; Low-Carbon Green City initiatives; establishment of legal systems and infrastructure for eco-tourism and walking trails; invigoration of low-carbon tourism services using low-carbon transportation, local food and local goods; and green transformation of infrastructure.

International and national context

Climate and environmental changes, as well as the energy-resource crisis that has been ongoing since the 1990s, have become an important factor in many countries' decisions to establish CC response policies as national tasks. As part of the United Nations Framework Convention on Climate Change (UNFCCC), adopted at the 1992 Environment and Development Summit in Rio, Brazil, as well as the subsequent Kyoto Protocol (1997), Bali Roadmap (2007), and the Copenhagen Agreement (2009), many countries have announced competitive GHG reduction targets. Coupled with the 2007–2009 global financial crisis, countries around the world had set economic recovery, response to CC, and energy security as national priorities. These circumstances accelerated the development of alternative energy technologies and actively promoted the reorganization of related government organizations and legislation around these priorities.

Korea was one of many countries that established CC as a national priority, and prepared the legal groundwork to support this priority. In 2008, the national government set Low-Carbon Green Growth as an operational goal, and enacted the Framework Act on Low Carbon, Green Growth ("Green Growth Act") in 2010, in accordance with which Korea's subsequent national policies for climate mitigation and adaptation have been implemented. At the 2012 Conference of the Parties to the Climate Change Convention (COP18), Korea also agreed to extend

the Kyoto Protocol to 2020 and launch the Post-2020 Climate Regime. After the declaration of Carbon Neutrality 2050 at the COP26 Special Summit in 2021, Korea drastically raised Nationally Determined Contributions (NDCs) goals by 40 % from 2018, levels from the original target of 26.3%. Korea also promised to participate in several international environmental protection initiatives, such as the Glasgow Climate Pact to reduce coal-power generation; the Glasgow Leaders Declaration on Forests and Land Use to stop deforestation and restore soil by 2030; the Global Methane Pledge to reduce methane emissions by 30%; and the Coal to Clean Transition Statement, which aims to phase out coal-power generation.

In line with these international efforts, Korea has made efforts to significantly reduce carbon emissions and prepare measures to adapt to the climate crisis across a variety of industries and sectors, including tourism and heritage. Table 2.1 outlines national policies and relevant laws for climate mitigation and adaptation in tourism and heritage.

Table 2.1 Laws, plans, policies and legal schemes for coping with climate change in the tourism and heritage sectors

Sector/field	Law	Plan / guideline	Legal scheme [S] / Policy task [T]
Climate change	– Framework Act on Low Carbon, Green Growth (2010-2021) – Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis (2021-present)	– Guideline for the GHG Target Management System	– [S] GHG Target Management System
	– Framework Act on Low Carbon, Green Growth (2010-2021) – Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis (2021-present) – Act on the Allocation and Trading of Greenhouse-gas Emission Permits	– Master Plans for Emissions Trading System	– [S] Emissions Trading Scheme
	– Framework Act on Low Carbon, Green Growth (2010-2021) – National Land Planning and Utilization Act	– Guidelines for Formulation of Urban or Gun Plans for Low-carbon Green City Development	– [S] Low-Carbon Green City
	– Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis (2021-present)		– [S] Carbon Neutral City
	– Framework Act on Low Carbon, Green Growth (2010-2021) – Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis (2021-present)	– Comprehensive National Plan for Climate Change Adaptation – 2nd National Climate Change Adaptation Plan (2016-2020) – 3rd National Climate Change Adaptation Plan (2021-2025)	– [T] Heritage monitoring and development of follow-up measures – [T] Strengthening multi-level governance in heritage risk preparedness – [T] Research on the adaptation schemes in tourism

Sector/field	Law	Plan / guideline	Legal scheme [S] / Policy task [T]
Environment / green transformation	– Environmental Technology and Industry Support Act		– [S] Eco-label certification – [S] Environmental Product Declaration (EPD) certification
	– Natural Environment Conservation Act	– Guidelines for Operation of Designation Scheme of Ecological Tourism Zone	– [S] Designation of Ecological Tourism Zone
	– Act on The Sustainable Management and Restoration of Tidal Flats and Adjacent Areas thereof	– 1st Master Plan on Management and Restoration of Tidal Flats, Etc.(2021~2025)	– [S] Designation of Ecological Village around tidal flats – [S] Ecotourism on tidal flats certification
Tourism	– Tourism Promotion Act	– 3rd Master Plan for Development of Tourism (2012-2021) – 4th Master Plan for Development of Tourism (2022-2031)	– [T] Awareness campaigns for sustainable tourism – [T] Establishment of an eco-friendly linear travel route in connection with historical and cultural resources – [T] Regeneration of modern industrial heritage and historic houses as tourism resources. etc.
	– Framework Act on Tourism	– 5th Master Plan for Tourism Promotion (2018-2022) – 6th Master Plan for Tourism Promotion (2023-2027)	– [T] Korea trail project and promotion of walking/ public transport trip – [T] Development of rural village-specialized food/accommodation/ activity content – [T] Construction of low-carbon lodging facility
Heritage	– Cultural Heritage Protection Act	– 4th Master Plan for Cultural Heritage (2017-2021) – 5th Master Plan for Cultural Heritage (2022-2026) – 1st Master Plan for Cultural Heritage R&D (2021-25) – National Strategy of Cultural Heritage Policy in the Post-COVID-19 Era	– [T] Establishment of continuous monitoring and management system for natural heritage – [T] Development of energy-saving air conditioning systems technology using the air conditioning mechanism of traditional buildings – [T] Development of disaster prevention technology – [T] Green transformation of modern cultural heritage and facilities

Source: Original table for this publication.

Policies based on climate-change laws

Climate-change mitigation and adaptation policies in Korea are being enacted and implemented based on the Green Growth Act, along with its successor, the Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis ("Carbon Neutrality Act"). Based on both of these laws, the GHG Target Management System, Emissions Trading Scheme, Low-Carbon Green City initiative and subsequent Carbon Neutral City, and the National Climate Change Adaptation Plans are being implemented as legal systems related to tourism and heritage.

Both the GHG Target Management System and the Emissions Trading Scheme, which cover up to 70% of national GHG emissions, are key policy measures designed to help the industrial sector reduce carbon emissions in Korea. As of 2022, there are six companies under GHG Target Management, and six companies assigned to the Emissions Trading Scheme in tourism. These consist of large-scale guest facilities such as hotel businesses and resort condominiums.[3] The number of companies subject to management, and their annual average GHG emissions, have increased since 2011, but decreased slightly since 2020 due to the impact of COVID-19.[4] Since the introduction of the two schemes, national GHG emissions have steadily decreased.[5] At the same time, sales of allocated companies have increased and the competitiveness of companies based on technological innovation has strengthened.[6]

The Low-Carbon Green City initiative has emerged as a new urban development paradigm based on the Green Growth Act, in line with a need for a transition from an energy-consuming urban structure, which generates more than 70% of global GHG emissions, to a low-carbon, energy-saving urban structure.[7] The Korean government has defined a Low-Carbon Green City as a city that leads green growth by reorganizing urban infrastructure and lifestyle into a low-carbon arrangement designed to reduce environmental pollution and respond to CC while creating jobs.[8] Since Gyeongpo District in Gangneung City was selected as the first example of this initiative, Low-Carbon Green City development projects have been promoted under the names of Zero Energy Town, Energy-Independent Village, and Low-Carbon Green Village in the cities of Geomdan, Dongtan, Asan-tangjeong, and Sosabeol, etc.[9] In these cities, increasing fossil-fuel substitution and energy use efficiency was made possible through the imposition of renewable energy facilities producing solar power, solar heat, geothermal heat, and fuel cells, as well as through the integration of environmental treatment facilities that restore ecological wetlands and expansion of water circulation systems.[10] The Green Growth Act was reorganized into the Carbon Neutrality Act in 2021, and the success of the Low-Carbon Green City program is leading to the development of a Carbon Neutral City.

The Comprehensive National Plan for Climate Change Adaptation ("Adaptation Plan") governs climate-adaptation projects throughout all sectors of Korean society, including tourism and heritage. In tourism, detailed measures are mainly research projects of new adaptation schemes such as adaptation inventory, climate insurance, green technology for use in tourism, national standards and certification of green tourism, and mileage targets and incentives.[11] Representative initiatives for the heritage sector include projects that focus on the development of follow-up measures based on the long-term monitoring of individual natural heritage and strengthening multi-level governance and management in cultural heritage risk preparedness.

Policies on the basis of environmental and green transformation laws

Korea also maintains green certificate schemes under laws related to the environment and green transition. Eco-label certification under the Environmental Technology and Industry Support Act is granted to products and services that reduce energy and resource consumption throughout the product lifecycle. As of 2022, two lodging companies (hotels) have obtained an eco-label.[12] Environmental Product Definition (EPD) certification is awarded based on quantitative calculation of environmental

performance,[13] and as of 2021, 58 services have been certified in the tourism sector.[14] These services span three categories: passenger service (air/land/rail transport and urban railway), lodging, and tour programs. In 2011 the Korean government imposed the world's first Carbon Footprint of Products (CFD) certification, which grants certification to EPD products and services that have achieved GHG reduction targets.[15] These certificate schemes are managed by the Ministry of Environment (ME) and are operated by the Korea Environmental Industry and Technology Institute (the certification body) and the Environmental Preservation Association (the educational institution for certification examiners). Once a product or service receives a green certificate, it is included on the mandatory purchase list of both national and local governments in accordance with the green product purchase promotion ordinance and can be displayed in designated green product sales places. A green certificate contributes to the image of certified companies that offer environmentally conscious products.

The Ecological Tourism Zone designation system is another scheme that pursues both sustainable conservation and utilization of natural heritage, with the intended effect of absorbing and storing carbon. Recently, the value of tidal flats as carbon reservoirs has been drawing attention. In particular, Getbol, Korean Tidal Flats' designation as a UNESCO World Heritage Site in 2021 resulted in the enactment of the Act on the Sustainable Management and Restoration of Tidal Flats and Adjacent Areas thereof ("Getbol Act"). This led to a new designation scheme, Ecological Village around Tidal Flats, as well as the Ecotourism on Tidal Flats certification.

Policies based on laws related to tourism

Tourism policies addressing CC are fulfilled through projects included in the Master Plans for Development of Tourism ("Tourism Development Plan") and the Master Plans for Tourism Promotion ("Tourism Promotion Plan").

Beginning with the Third Tourism Development Plan (2012-2021), which set the direction of national tourism development for 10 years, the need to consider CC response during tourism development was included in the government's policy stance of pursuing "Low-Carbon Green Growth". For example, the plan included a pilot model for low-carbon green tourism development and a carbon-emission management system for the tourism sector to establish a new framework of tourism development and relevant tourism management system.[16] Other instrumental support measures—such as designation of national trails, construction of eco-friendly linear travel routes linked to historical and cultural resources, and expansion of new renewable energy for tourism facilities—were also promoted for the spread of low-carbon green tourism.[17]

The government's efforts were further developed in the Fourth Tourism Development Plan (2022-2031), which prioritized tourism's CC response by including "implementation of sustainability value in tourism development" as the second of six total strategies. While the plan is supervised primarily by the Ministry of Culture, Sports and Tourism (MCST), cooperative ministries include the ME; the Ministry of Trade, Industry and Energy (MTIE); the Ministry of Land, Infrastructure and Transport (MLIT); the Ministry of Employment and Labor; the Forest Service; and the Rural Development Administration. Detailed tasks include setting carbon-reduction targets and utilizing renewable energy during tourism development projects, green remodeling, developing a linear ecotourism travel route in connection with the Korea Dulle-gil trail (hereafter "Korea Trail" and described in greater detail later in this report), regeneration of idle facilities such as modern industrial heritage and old houses as tourism resources, and development of tourism resources by utilizing the idle time of tourist attractions.[18]

Until the Fifth Tourism Promotion Plan (2018-2022), a detailed yet short-term legal plan, the main issue for Korea was simply development, and the goal of any tourism policies less burdensome to the environment were focused on closing the development gap between the Seoul metropolitan area and rural areas, which is a chronic problem in Korean society, rather

than responding to CC.[19] The promotion plan included policy measures such as public transportation tourism promotion aimed at improving access to local tourism, ecotourism promotion using natural heritage as unique local tourism resources, Korea Trail development, and tourism content development related to local food/accommodation/experience specializing in rural areas.[20]

As eco-friendliness and sustainability emerged as important policy directions with discussion on the tourism sector's CC response and carbon reduction during the COVID-19 pandemic, the Sixth Tourism Promotion Plan (2023-2027) was promulgated and includes detailed tasks for low-carbon, eco-friendly and sustainable tourism, administered through the ME, the Cultural Heritage Administration (CHA), the Ministry of Oceans and Fisheries, the Ministry of Agriculture and Food, and the Forest Service, with the MCST as the primary government agency ultimately responsible.[21] Such tasks are included not only as part of national domestic tourism policy to enhance the overall sustainability of the tourism field, but also in regional and local tourism policies that pursue the production of attractive local tourism products and services, thereby providing eco-friendly and sustainable value in various ways. For example, the plan supports building a GHG inventory and carbon reduction consulting agency for tourism companies. In addition, projects are underway to improve local accommodation conditions by creating eco-friendly small lodging facilities, such as "Ecochon (Eco Village, described in more detail later in this chapter)", and utilizing local old houses. At the program level, a low-carbon forest road tour program is under development that links forest welfare facilities, cultural assets, local lodging, and local restaurants based on the use of public transportation. In connection with corporate environmental, social and governance (ESG) management and social contribution activities, improvement measures of remote work and Workation system using vacant houses are being reviewed to increase demand for rural tourism. Various public awareness campaigns are also being promoted to create an eco-friendly travel culture, encouraging public participation.[22]

Policies on the basis of cultural heritage laws

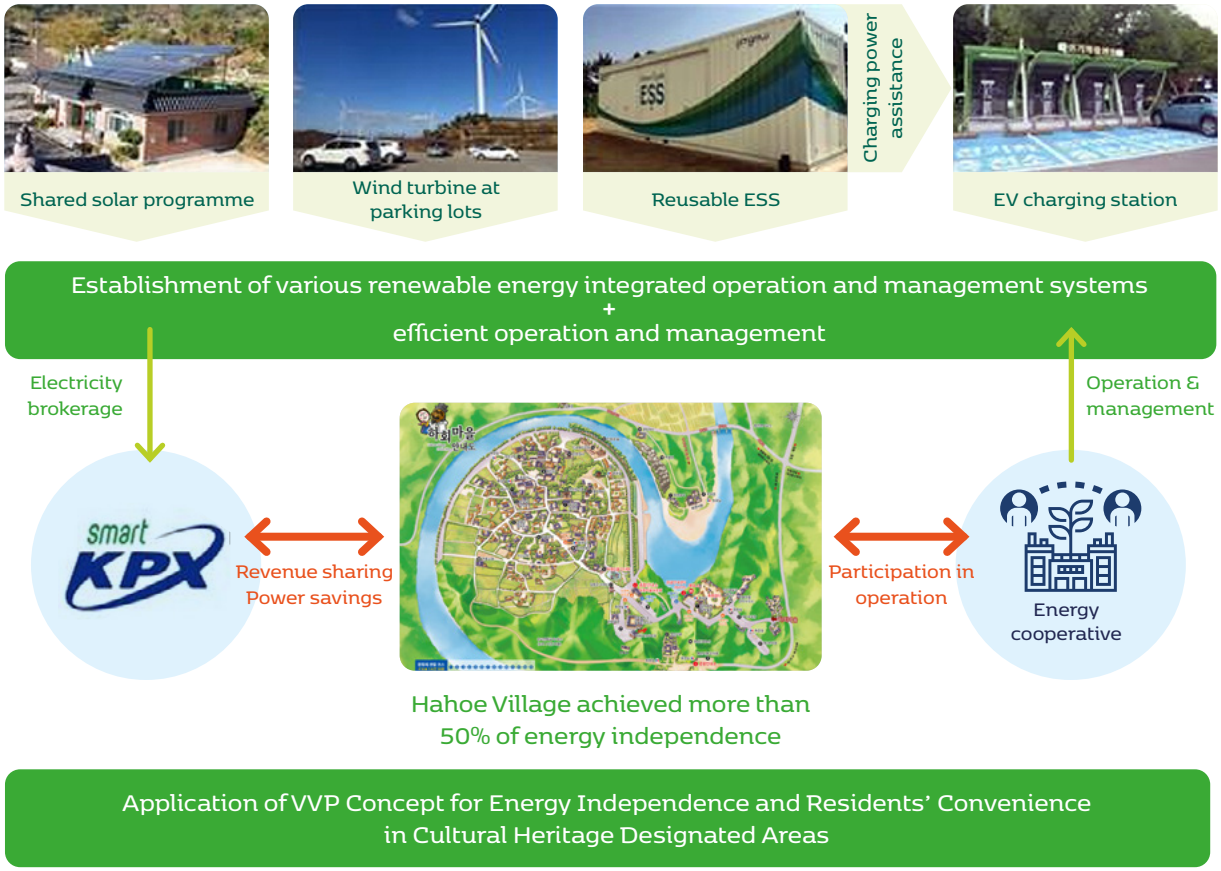
Climate-change measures in the heritage sector began to be included with the 4th Master Plan for Cultural Heritage (2017-2021), among the statutory comprehensive plans for the preservation, management and utilization of cultural heritage. The primary purpose of several projects included in the Plan is to establish a periodic monitoring and integrated data management system that reflects the characteristics of natural heritage sensitive to CC.[23] This measure was further developed in the 5th Master Plan (2022-2026), which included: enactment of a law specializing in natural heritage protection, projects for ecosystem function recovery, proliferation of protected species, and research projects for restoration and genetic information for protected species.[24] Two green transformation projects are also included as mitigation measures. One is a project to improve energy efficiency for modern and contemporary-built heritage currently used as schools, and the other is the establishment of green transportation infrastructure that provides visitors access to major tourist destinations in the so-called Ancient Cities: Gyeongju, Gongju, Buyeo and Iksan.[25]

The 1st Master Plan for Cultural Heritage R&D (2021-25), a sub-plan of the 4th Master Plan and administered by the National Research Institute of Cultural Heritage (NRICH), also includes two research projects that fall under CC adaptation and mitigation measures. One is the development of energy-saving air conditioning technology derived from the air conditioning mechanism found in traditional buildings. The purpose of this study is to investigate the mechanism of dehumidification, ventilation, and constant temperatures of Janggyeongpanjeon Depositories of Haeinsa Temple, Seokguram Grotto, and Seokbinggo Stone Ice Storage, with the intention to, ultimately, utilize them for document and cultural asset storage. Development of disaster prevention technologies related to abnormal climate is another initiative.

Meanwhile, green transformation of cultural heritage facilities was included as one of the seven key tasks in Korea's National Strategy of Cultural Heritage Policy in the Post-COVID-19, a 10-year plan set to terminate in 2030.[26] A smart grid system project for eight folk villages has been newly included with the aim of improving the convenience of residents living in cultural heritage sites. The system supplies customized power based on real-time power usage by location and time of consumer use.

The creation of a micro-grid system in Hahoe Village in Andong City, a state-designated cultural heritage and also inscribed on the World Heritage List, is drawing particular attention in that it is the government's first attempt at such a system in an inland village. The Gyeongsangbuk-do provincial government, where Hahoe Village is located, won the MTIE's endorsement in a competition among local governments for the right to receive funding and support from an MTIE-led entity (Development of New Renewable Energy-Based Village-Unit Microgrid Technology) to develop a local micro-grid system (Figure 2.1). As a result of being selected for the project, Hahoe Village will receive KRW2.6 billion (KRW1.8 billion in state funds) over the course of three years, beginning in 2022. The project aims to help Hahoe Village achieve, through use of the micro-grid, 50% energy self-sufficiency by 2024 based on two types of renewable energy, 344kW of solar power and 4kW of wind power. Unlike large-scale power production facilities, a micro-grid does not require separate power transmission facilities due to its close proximity to production facilities and supply areas, resulting in cost reduction.

Figure 2.1 Hahoe Village: Development of new renewable energy-based village-unit using micro-grid technology



Source: Gyeongsangbuk-do Province, 2021. Note: originally labeled in Korean.

Detailed methods and practical achievements

Climate-change mitigation projects

Sustainable conservation of natural heritage and popularization of low-carbon travel services through ecotourism laws, legal schemes, and plans

Linking the law on ecological tourism and related systems and plans enabled the promotion of low-carbon travel services that consist of local heritage, local food, and hands-on activities related to low-carbon transportation. The Natural Environment Conservation Act requires tourism businesses in 29 Ecological Tourism Zones to have Ecotourism Directors who are local residents and support local communities to be involved in tour programs involving food, activities, and accommodation.[27] This plays a big role in the growth of Korea's ecotourism market and further promotes low-carbon travel culture.[28] The granting of EPD certification for ecotourism and accommodation services has also helped. As a result, as of 2021, 24 ecotourism programs have been certified on the EPD and two programs have been certified low-carbon products or services, CFD.

In particular, the case of Jeju Seonheul-ri ecotourism programs is very encouraging. Two 2-day programs based on well-preserved heritage and unique village community culture obtained CFD by introduction of photovoltaic power generation facilities reducing carbon emissions from the programs by 99% by adding the use of local agricultural products and bicycles.[29] In response, the Jeju Tourism Organization has been successfully operating the ECO Party program, a small one-day village festival, which began in Seonheul-ri, since 2016 (Photo 2.1). Each village offers various programs for 30-50 people per session such as eco-friendly ecological experiences, traditional raft riding and trekking, and tasting and making local food. In the first year of 2016, there were only four participating villages, including Seonheul-ri, but the number of participating villages increased to 15 in 2019, when villages began to make profits through participation fees and sales of specialties.[30] The number of participants and participating villages is increasing significantly every year, from 267 participants (four sessions) in 2016 to 1,268 participants in 2019 (45 sessions).[31] Eco Party is considered a new model of sustainable tourism, where local residents take charge of planning, preparation, and performing all programs.

Photo 2.1 ECO Party activities: Local product market, walking trails, local food tasting, and natural heritage tour using traditional rafts




Source: Jeju Eco Party Facebook 2023, Visit Jeju 2023.

Development of low-carbon historical and cultural tourism cities

As part of the new urban planning paradigm of Low-Carbon Green City, a representative example of a city utilizing cultural heritage and natural resources for low-carbon efforts is Gyungpo District in Gangneung City. Gyeongpo has long been the center of Gangwon-do Province. With Mt. Seorak to the west and the clear blue East Sea and lagoons to the east, it is a popular travel destination throughout the year, rich in cultural heritage sites such as government offices and pavilions and the birthplace of notable figures and celebrities from the 10th to the 19th centuries. The project targeted an area of 18.3km^2 where these historical, cultural, and natural resources are distributed. In total, 29 projects in the green transportation, energy, water/resource circulation, and green tourism sectors were scheduled to be carried out by 2020,[32] while some projects such as water reuse plant facilities and carbon-zero school operation are still ongoing.[33] This low-carbon city development project was organically linked with the 3rd Tourism Development Plan so that Gyeongpo could be cultivated as a green cultural tourism city in harmony with history and tradition.

The main achievement of the Low-Carbon Green City program in Gyeongpo is the creation of a cultural and ecological travel route by restoring lagoon wetlands and constructing a low-carbon traditional village, both of which connect to the existing tourist destinations

between them so that visitors can enjoy traveling between tourism resources on foot rather than by car (Map 2.1).[34] Through the restoration of wetlands surrounding coastal lagoons, the biodiversity of plants and animals that inhabit the wetlands was secured. These include the revival of Prickly Lotus, a Class 2 Endangered Plant, otters, a Class 1 Endangered Species, and the transformation of the restored wetland into a habitat for migratory birds.[35] The revived ecological landscapes have become harmonized with the existing cultural heritage sites such as Gyeongpodae Pavilion, Seongyojang Missionary Hall, and the birthplace of Heonanseolheon, along with the wetland behind Gyeongpoho Lake, to create an appealing travel route.

Map 2.1 Gyeongpoho Lake travel route after lagoon wetlands restoration projects

Original Image Source: Wonju Regional Environmental Office, 2023. Note: Main tourist destinations labeled in English.

The second part of the Low-Carbon Green City project in Gyeongpo involves the development of a low-carbon, sustainable traditional housing and cultural experience space, Ojuk Hanok Village complex, nearby to the Ojukheon cultural heritage site, a representative tourist destination in Gangneung. The complex was a result of the first public contest for the construction of a New Hanok Certification Complex by the MLIT and consists of 21 buildings covering an area of 12,300 (Photo 2.2).[36] The buildings are Hanok-type passive houses that enhance thermal performance and energy efficiency using renewable solar energy. Construction costs were reduced to 60% of traditional Hanok, while the disadvantages of traditional Hanok construction, such as the cold and poor sound insulation, were greatly improved.[37] The complex has had the effect of expanding tourism resources that utilize traditional culture in a sustainable way and further extending the local stays of visitors without compromising the value of the existing cultural heritage area (Photo 2.3).

Photo 2.2 Gangneung Ojuk Hanok Village

Source: Gangneung Ojuk Hanok Village, 2023.

Photo 2.3 Traditional culture experience in Gangneung Ojuk Hanok Village

Source: Gangneung Healthcare Healing Center, 2023.

In addition, the overall urban environmental infrastructure in Gangneung is actively utilizing renewable energy and pursuing energy diversification. The city follows a carbon-neutral program for basic environmental facilities that incudes photovoltaic power plants in the sewage treatment plant, wind power plants, solar streetlights, and hybrid streetlights, reducing 479 tons of carbon dioxide annually. Gangneung's local government is the first in the country to operate a small hydroelectric power plant and the nation's largest solar power plant simultaneously.

Gangneung plays a leading role in implementing Korea's green city model. In 2015, it won the Environmental Management Award at the 23rd Chosun Ilbo Environment Awards, co-hosted by the ME and the Chosun Ilbo Newspaper, in recognition of its contribution to creating an eco-friendly ecological city, and won the Prime Minister Award at the 7th Green City Award (Award of Excellent Local Government in Environmental Management), also hosted by the ME.[38] The city has been carrying out a series of green technology projects in connection with the selected Smart Green City project, with a total project cost of KRW10 billion (6 billion from national expenditures, 1 billion from provincial expenditures and 3 billion from city expenditures).[39]

Popularization of walking trips and expansion of low-carbon travel: Korea Dulle-gil Trail

The development of the Korea Trail, which ushered in the popularization of walking tours, is one of the tourism policies that the Korean government has been promoting extensively as part of its efforts to expand low-carbon travel. With the boom in walking trips that began with the opening of the Jeju Olle Course, a coastal walking trail on Jeju Island, the MCST launched in 2009 a nationwide project to build eco-friendly linear travel routes by connecting cultural and ecological trails along the coastline in support of green policies. The project began in earnest with KRW9 billion invested for three years until 2019, establishing Haeparang-gil along the east coast (750km, 50 courses), Namparang-gil along the south coast (1,470km, 90 courses), and Seoharang-gil on the west coast (1,800km, 109 courses)(Figure 2.2). The most recently developed course, the DMZ Peace Road, was scheduled to open in April 2023.[40] Once the entire 4,544 km section is completed, this project will be the only tourism policy promoted by four consecutive government administrations.

With the tourist population gradually recovering to pre-pandemic levels after COVID-19, surveys indicate that one out of three Koreans enjoys walking trips, and the participation rate of not only the middle-aged but also young people is increasing, raising the demand for walking tours even further.[41] The government continues to connect existing segmented local tracks in an eco-friendly manner through Tourism Promotion Plans. Sojourn-type walking tour programs, traditional cultural experiences, ecological experiences, and local food gourmet tours that encourage longer visitor stays by linking the cultural and natural heritage of each region are highly popular among local governments. The national government is promoting a low-carbon travel campaign involving walking clubs, advancement of a location-based integrated platform, and establishment of a multilingual guide system.[42]

Figure 2.2 Korea Dulle-gil Trail courses

Source: Durunubi, 2023 (left); World Bank (right).

Climate-change adaptation projects

Adaptive management based on heritage-monitoring results and development of damage-detection technology based on intelligent image information analysis

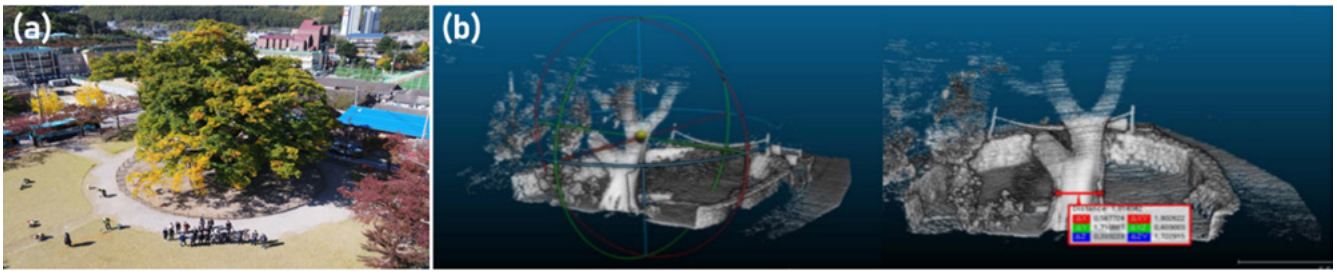
Although cultural and natural heritage sites deserve protection for their originality and historical, academic, and cultural values, they also need to be preserved for their value as tourism resources that generate additional revenue in a local community. Accordingly, the CHA continues to monitor heritage and develop follow-up measures, utilizing advanced technologies and indicators applicable to risk preparedness for heritage.

First, adaptive conservation management is being conducted based on the monitoring results accumulated so far to increase the number of protected species, modify and expand protected areas, and minimize heritage damage attributed to CC. For example, in monitoring seasonal and topographic changes affecting protected flora and fauna species, the global migration route of Chinese Egrets (Egretta eulophotes) was confirmed for the first time. This made it possible to help increase the population of these protected species by adding artificial nesting sites, of which 100% were used for breeding along these routes. Monitoring also confirmed that Jeju Jipmyung Moths (Orthaga olivacea), which harm protected forests, showed earlier eclosion phases than scheduled, which is directly related to damage of young tree leaves. Because of this discovery, emergency control measures were put into place and damage in the protected forest was minimized.[43] Based on the results of these ongoing programs, adjustments to protected areas for protected species, introduction of rest years, and manuals for heritage site-specific management are being implemented.[44]

High-tech sensors and detection technology have also been developed to identify the effects of CC on heritage and to prepare countermeasures accordingly. The National Research Institute of Cultural Heritage (NRICH) is developing three-dimensional aging diagnosis technology for large-area cultural heritage sites. Using Haemi-eupseong village as an example, maps depicting individual buildings, topographic features and vegetation status have been constructed as three-dimensional models for aging diagnosis.[45]

Other methods are also being implemented—including measures to evaluate the quality of roof tiles by applying a hyperspectral sensor, construction of a spectral database for old trees and exotic species with machine-learning techniques, application of drone photography and 3D digital recording (Figure 2.3), development of autonomous aerial and ground exploration equipment, and detection technology for termite groups and activity.[46]

Figure 2.3 Technologies to support heritage management: Drone photography and 3D digital recording with LiDAR



Source: Cultural Heritage Administration, 2021. Note: a = Long-leaf Zelkova of Dogye-ri, Samcheok, b = Carstor Aralia of Gungchon-ri, Samcheok.

Sustainable heritage management through cooperation with local residents

Since 2022, the CHA has been operating a public-private partnership program, Dangsan Tree Grandfather, as part of its multi-level governance strengthening policy for sustainable management of local natural heritage and cultural landscapes (Photo 2.4). For each of the 176 old trees designated as Natural Monuments, one village representative is appointed to help protect and manage the tree and transmit folk events. When the largest wildfire in Korean history occurred in Gangwon-Gyeongbuk region in March 2022, three Dangsan Tree Grandfathers, cooperating closely with the government in real-time from the affected areas of danger, responded promptly to the unfolding situation and managed to protect the precious heritage from the wildfires.[47]

Photo 2.4 First national convention of Dangsan Tree Grandfathers

Source: Cultural Heritage Administration.

Identifying climate impacts across the Korean heritage sector and establishing a CC response

The government has worked to comprehensively identify the impact of CC on the overall heritage sector and to establish a policy direction for future CC response since the recognition of CC damage and subsequent measures on heritage have only been sporadically conducted and almost exclusively for the natural heritage sector. One important task currently being carried out is establishing a disaster damage database of heritage assets to identify general trends and detailed characteristics of CC impact, and to use this data in assessing the vulnerability of heritage to CC. Data is collected from Reports on Disaster Damages to Heritage that are uploaded to the CHA by local governments when damage occurs to designated heritage assets.[48] Second, a comprehensive report was recently published examining the impact and response status of CC, with contributions from Korean experts in climate, disaster science, and heritage fields. The report seeks to identify the current status of CC effects by the type of cultural and natural heritage in Korea, offers detailed measures applicable to the heritage sector, and establishes a CC response policy direction necessary for Korea at this stage.[49] Based on these works, a comprehensive plan for CC response by the CHA is scheduled to begin in July 2023.

Spreading awareness of sustainable travel

With the announcement of the 2050 Carbon Neutral Strategy in 2020, the MCST and the Korea Tourism Organization, a government-invested institution within the MCST, as well as public organizations in tourism are promoting various campaigns to improve public awareness. These include environmental cleanup activities at travel destinations. Activities include plogging (a term combining the word "jogging" with the Swedish word "ploccka upp", which means picking up), beachcombing, eco-friendly camping events, walking travel challenges, etc. The Korea Tourism Organization has conducted a nationwide campaign to support the Korea Trail system and has officially certified it as a volunteer activity. Another recent example was a campaign at major beaches to provide sea-related snacks based on the weight of garbage that visitors collected.[50] The 6th Tourism Promotion Plan, which begins in 2023, promotes embedding a culture of sustainable travel with more active tasks such as sustainable travel campaigns that encourage public participation and the development of best sustainable travel destinations. The MCST plans to establish a local camping festival and camping site certification system as camping trips are becoming popular due to the COVID-19 pandemic.

SWOT analysis based on the policy review

Based on the various plans and systems derived from the policy framework discussed in previous sections of this chapter, this section presents a strengths, weaknesses, opportunities, and threats (SWOT) analysis in consideration of environmental changes and internal capabilities related to CC response policy in the Korean tourism and heritage sectors.

Strengths

Active and orderly implementation under the leadership of the national government

In tourism, stakeholders span the public sector, such as central and local governments, and the private sector, such as tourism businesses and academia, as well as city and regional planning, environmental organizations, and industry. Nonetheless, the MCST can efficiently implement policy measures to cope

with CC in that it has experience in successfully operating projects to accomplish locally-led tourism policy. One example is Tourdoore, a business start-up revitalization project for local residents.[51] In the heritage sector, a close working collaboration has been established between the CHA, the NRICH, research institutes, and local governments.

Explicit policy direction of carbon neutrality and the will to promote CC response policies in tourism and heritage sectors at the national level

With the government's recent move to prioritize carbon neutrality under general state affairs, the tourism sector has already achieved some sustainable tourism policies since the 3rd Tourism Development Plan in 2012, such as designating Ecological Tourism Zones, fostering eco-tourism, and reviving the popularity of walking trips.[52] Recently, under the 4th Tourism Development Plan (2022-2031), the promotion of carbon-neutral tourism development was selected as a priority task, and matters related to address CC were stipulated in Article 48-3 (Revitalization of Sustainable Tourism) of the Tourism Promotion Act:

> The Minister of Culture, Sports and Tourism may take necessary measures, such as providing information and financial support, etc. in order to promote the development of sustainable tourism resources, which can help minimize the use of energy and resources, cope with climate change, reduce environmental destruction, strike a balance with the lives of local residents, and achieve a win-win development with the local economy.
>
> (Amended on Dec. 3, 2019)

Since 2021, the CHA has also been promoting a project to convert cultural heritage and related facilities to low-carbon facilities and improve energy efficiency. It has selected CC response as one of its major strategic tasks every year and began mitigation and adaptation initiatives in the heritage field in earnest in 2022.[53] In April 2023, the Framework Act on National Heritage was enacted, which includes provisions for responding to CC, and, beginning in July 2023, state and local governments plan to implement mitigation and adaptation measures based on the Comprehensive Plan for National Heritage to Cope with CC.[54]

Weaknesses

Uneven implementation of CC response policies

The government's adaptation and mitigation policies are scattered and lack the cohesion of a single overarching plan. In terms of the tourism sector, CC response and carbon neutrality are still recognized as areas with low policy execution power, although related studies have been conducted to reduce GHG emissions.[55] The government's plans are still insufficient to substantially reduce tourism-related emissions in transport, food, and goods since Korea only just began a number of low-carbon tourism policy initiatives. The government has also been pushing for steps to establish an emission measurement system for the tourism sector since 2021, which will enable the government to set and implement more specific and practical reduction measures for each detailed sector. As for heritage, adaptation measures for natural heritage are included in both the Master Plans for Cultural Heritage and National Adaptation Plans, while measures for cultural heritage are only featured in the Adaptation Plans. Mitigation measures are included in the Basic Plan and Post-COVID Strategy, but the targets are limited to modern built heritage and folk villages. Adaptation and mitigation measures for intangible heritage are not addressed. In terms of content, both tourism and heritage CC response policies are currently limited to obtaining data on damage and impact of CC as well as basic research on the introduction of the relevant systems. In addition, the heritage sector has been relatively neglected in mitigation policy due to the perception that its contribution to total carbon reduction is already so low that carbon reduction effects would be insignificant compared to other sectors.

Lack of a centralized policy management entity

There is no centralized department dedicated to managing CC and carbon neutrality measures in tourism and heritage sectors. In tourism, current CC response policy is administered in two ways. Projects under the Tourism Promotion Plan and the Tourism Development Plan fall under the jurisdiction of the MCST, while tourism industry tasks in the National Adaptation Plan are under the jurisdiction of the ME. Most tourism-related tasks in the Adaptation Plan fall under basic research for preparing policy measures. However, close collaboration between the two ministries are required so that the Adaptation Plans and Master Plans can pursue more effective measures that yield practical success. In addition, it is imperative to establish and continuously operate a consultative body that takes into account both the public and private sectors as there are various stakeholders in the tourism field. Although there had been a consultative body in which the MCST, representatives from tourism corporations and the tourism industry, executives of large companies (accommodation and amusement facilities) with high carbon emissions, and energy and environment experts participated with the goal of reducing GHG emissions, their activities were suspended in 2021.[56] As for the heritage sector, CHA policies to address CC are being implemented individually. The natural heritage sector began participating in the Adaptation Plan in 2016 and the cultural heritage sector's participation commenced in 2021. The intangible heritage sector has not yet begun its involvement. Furthermore, only two departments, the Natural Heritage Division of the CHA and the Safety and Disaster Prevention Division of the NRICH, are responsible for adaptation measures. As a result, an integrated policy based on mutual cooperation between ministries on joint measures is, thus far, not in place.

Opportunities

Increased policy acceptance due to heightened social awareness of climate crisis

International and national consensus on the crisis facing tourism and heritage is spreading as more and more people are experiencing damage due to frequent abnormal weather. "Eco-friendliness", "Efforts to respond to CC", and "Sustainable development considering human/environmental resilience" were selected as major environmental issues requiring national priority, according to a survey of citizens and experts which was conducted during the COVID-19 pandemic,[57] implying a high adaptation and mitigation policy acceptance. In addition, it is now considered appropriate to encourage visitors to act in socially responsible ways and to consider environmental protection, fairness, and ESG when choosing products and services.

The right time to strengthen CC response policies in the wake of COVID-19

As for tourism, it could be the right time to strengthen mitigation policies when carbon emissions have significantly decreased due to the impact of the pandemic. In the case of the heritage sector, the CHA's Comprehensive Plan for National Heritage to Cope with CC could be seen as a significant turning point in the mid- to long-term conservation and management of heritage. The plan can serve as an opportunity to establish public-private partnership governance that promotes active participation of local communities, while conducting policies according to an organizational system led by the government. Although tourism and heritage sectors' participation in response to CC has been delayed, this may have the effect of reducing trial and error by benchmarking and utilizing pre-established outputs from other fields already in place, such as agriculture, forestry, marine and fisheries, land and transportation, and energy.

High potential of new technologies applicable to mitigation and adaptation

With the rapid growth of science and technology such as big data, Artificial Intelligence (AI), and 5G, new ways of preparing mitigation and adaptation measures are also emerging. Many expect that it

will be easy to secure high-quality cultural heritage information and content based on these new technologies, which could, for example, help identify customized measures to individual heritage sites or tourist destinations or manage the entire process of developing, applying, revising, and supplementing countermeasures. In particular, it is expected that the perception of cultural heritage as a source of knowledge for low-carbon energy savings will be expanded based on the ongoing research on natural ventilation mechanisms in traditional buildings for the purpose of applying them to the storage of cultural assets.

Threats

Diverse and complex problems and uncertainties caused by CC beyond existing management standards and policies

The tourism and heritage sectors, as well as CC, are expected to evolve with mutual and overlapping influences. Transportation, accommodation, tourist facilities, and tourism activities are mostly energy-intensive, directly affecting global warming by reducing green areas such as forests and farmlands.[58] CC affects tourism infrastructure, reducing the attractiveness of tourist destinations, damaging the environment, changing tourism seasonality (peak- and off-seasons), and increasing conflict with other developments whose impacts are expected to intensify in the future.[59] Changes in tourist preferences and behaviors are inevitable due to the direct and indirect effects of CC, and these changes can have a cascading effect on the overall tourism business.[60]

Conflicts due to intensifying development pressure and human interference

Diminished scenic value of tourist destinations and heritage properties have recently emerged as a social problem due to intensifying development pressure. In Korea, Historic and Cultural Environment Preservation Areas (hereafter "Preservation Areas") are designated by municipal ordinances as having a maximum range of 500m outside the cultural property protection zone. The problem is that most of these lands are privately owned—and it is difficult to manage development projects outside 100 to 500m under the current law, even if they are located within the main viewing area of a site that requires wide-scale historical and cultural landscape management. Furthermore, there are growing problems of artificial interference and environmental pollution that reduce the attractiveness of tourist attractions.

Lessons learned and conclusions: Remaining challenges and the way forward

Major national policies related to CC response in Korea's tourism and heritage sectors are in line with Low-Carbon Green Growth policies. This section summarizes, through policy analysis, the characteristics of policies currently being implemented.

First, CC response national policies have been planned with a top-down approach led by the government. The lack of awareness and information about CC also made bottom-up policy establishment difficult in the early stages.[61] However, CC is a macroscopic phenomenon that calls for urgent countermeasures, and it is necessary for the national government to lead policies with a defined direction. Low-Carbon Green City projects, such as for the Gyeongpo District, could have been led by the government, and other local governments are preparing Low-Carbon City conversion plans suitable for their own situations.

Second, Korea's CC response policy has focused on establishing a foundation for codification of relevant laws and systems as well as R&D. Adaptation measures in tourism and heritage are being fulfilled mainly through the National Adaptation Plans, and mitigation measures are being implemented as part

of the Master Plans for tourism, Cultural Heritage Master Plans, and the Strategy for Post-COVID-19 Era. However, there is a pressing need for systematic policy management within ministries, cooperation between different ministries, and the formation of a consultative body consisting of public-private-academia, including indigenous communities, through the operation of a dedicated department or task force.

Third, CC adaptation methods in Korean tourism and heritage include monitoring and follow-up measures, development of advanced detection and diagnosis technologies, development of vulnerability tools and databases, and awareness-raising campaigns on the need to cope with CC. Mitigation measures include carbon reduction systems, Low-Carbon Green City initiatives, establishment of legal systems and infrastructure for eco-tourism and walking trails, invigoration of low-carbon tourism services using low-carbon transportation, local food and local goods, and green transformation of infrastructure, among other initiatives.

While Korea's national government effectuates policies addressing the broader tourism and heritage sectors, each local government imposes detailed action plans depending on its local environment and conditions. Actions to address CC through adaptation and mitigation at the city level will make crucial contributions to national efforts aimed at fulfilling international commitments.[62] Seoul Metropolitan City, Suwon City, and Jeju Special Self-Governing Province are examples of local governments in Korea that are well equipped to cope with CC and carbon neutrality in tourism and heritage. Seoul imposes CC response measures more quickly and systematically than any other local government. It has the highest density of cultural assets and the highest urbanization rate in Korea and has been steadily seeking ways to harmonize the sustainable preservation of cultural heritage and urban environment. Suwon City was created through a planned urban construction project in the 18th century. The unique local community around Suwon Hwaseong Fortress, a listed World Heritage Site, is highly active and many experimental policies are being implemented there in accordance with the Low-Carbon Green Policy stance. Jeju Province is an island tourist destination with high status and visibility in East Asia. While the tourism industry occupies an important position in the Jeju economy, it is also the sector most vulnerable to CC due to Jeju's location as a subtropical island. In response, the Jeju local government and the Jeju Tourism Organization are actively imposing various climate actions. The details and measures being taken at tourism and heritage sites in each of these cities are described in the case studies in the subsequent chapters of this report.

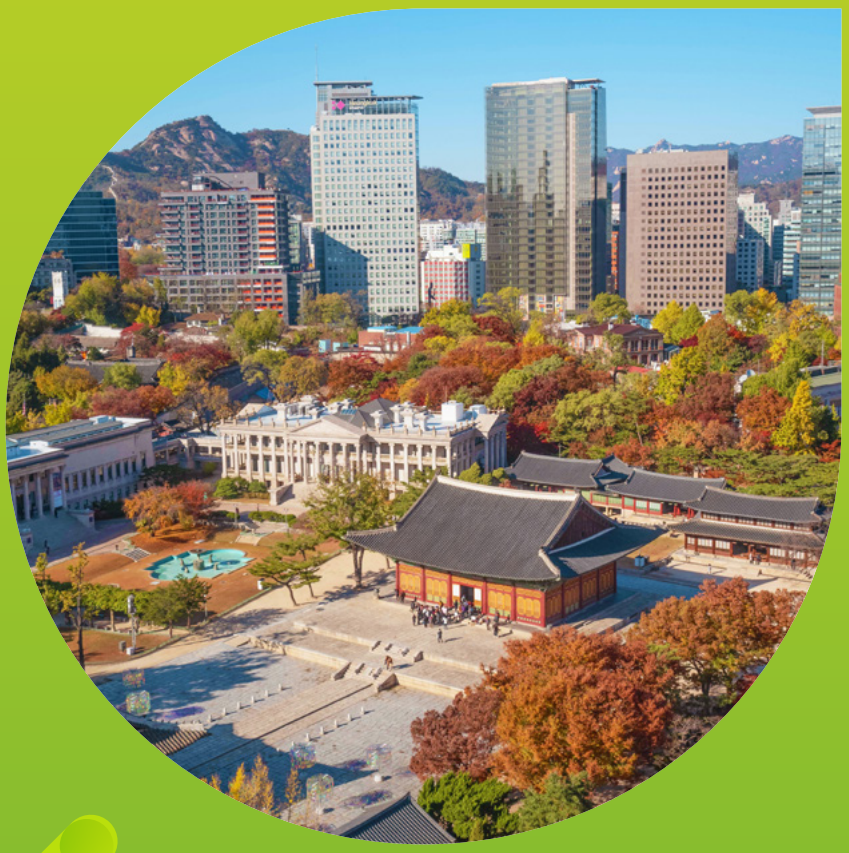
Examining Korea's CC mitigation and adaptation policies to date, one of the remaining challenges to be resolved is raising funds to subsidize costs to support the various incentives required to implement carbon neutrality in tourism and heritage.[63] Many businesses in the Korean tourism and heritage sectors are small, so it is difficult to expect voluntary efforts to cope with CC unless realistic profits are assured.[64] Participation of the private sector is essential, but it is all the more necessary to prepare a legal basis to prioritize the execution of finances for green tourism policies, given the small size of many Korean tourism businesses. Although it is currently possible to secure financial resources using the Tourism Promotion and Development Fund, new funds such as a carbon tax are essential at the pan-governmental level in the long term.[65] Funds already in operation include the Climate Response Fund and the GHG Reduction Cognitive Budget System, which falls under the jurisdiction of the Ministry of Strategy and Finance, for securing the necessary financial resources to accomplish 2050 carbon neutrality. Based on the 2023 budget, KRW2.4867 trillion was allocated to the Climate Response Fund and KRW11.8828 trillion to the GHG Reduction Cognitive Budget System.[66] Local governments have formed consultative bodies with relevant organizations to improve related laws and systems and are conducting pilot projects.[67]

It is also necessary to legislate various support and compensation system measures that can incentivize active participation of the private sector through financial resources prepared in this way.[68] Thus, it is necessary to prioritize setting specific carbon emission targets for each detailed area based on providing energy performance measurement tools to related stakeholders. Korea began a project to

develop a carbon-emissions measurement system for tourism businesses in 2022. Support methods being reviewed in Korea include direct support that provides for the costs required for capacity-building and imposition of various technologies related to energy saving and GHG reduction, and indirect support such as consulting that links specialized organizations and experts.[69] A plan to expand the GHG Target Management System, currently in operation, to have tourism enterprises set carbon reduction targets themselves and provide incentives for achieving them is also being discussed.[70]

Identifying specific aspects in which the heritage sector could contribute to carbon neutrality should also be considered, as the draft revision of the climate change policy document discussed at the World Heritage Center in 2022 also pointed out.[71] In Korea, many traditional practices disappeared during the Japanese colonial era and the Korean War, and due to rapid industrialization and urbanization. Nevertheless, it is necessary to actively discover traditional methods that can serve as CC adaptation and mitigation measures today for both sustainable utilization of heritage and less carbon-intensive tourism. For example, establishing zones of fire-resistant forest such as evergreen broad-leaved forest based on a Nature-Based Solution approach is a form of traditional fire prevention and wind protection practice used by temples during the Joseon Dynasty (14th to 19th century). This could minimize the need to install artificial disaster-prevention facilities that lower landscape value, while replacing coniferous forests that are threatened by overall rising temperatures and make forest fires more dangerous.

Looking at the Korean government's efforts, and results of those efforts, in tourism and heritage sectors to date, we can offer three recommendations to developing countries to make their industry less carbon intensive. First, it is necessary to identify resource availability at the national level, including legislation, finance, manpower, and infrastructure. This work lays the foundation for deriving available solutions with appropriate budgets, personnel, and infrastructure tailored to each country's circumstances. Second, raising visitors' awareness of CC is required. Even if suppliers in the tourism industry such as tourism resource managers emphasize green tourism and green technology, raising awareness is critical to meet the needs of consumers (tourists), due to the nature of tourism.[72] Visitors should learn to bear some inconvenience by having them frequently come into contact with awareness-raising campaigns and user-friendly emission-related devices, such as carbon footprint measuring devices, at travel destinations. Lastly, allowing the voices of various stakeholders included in the decision-making process is the optimal direction to move forward under a government-led policy framework. Bottom-up measures should be encouraged in the long term to achieve more effective results at the national and regional levels, and this requires fostering partnerships among government agencies, local governments, private organizations, academic expert groups, and local communities so that, together, they can develop locally-tailored policy measures and continuously participate in evaluation and monitoring.[73]



Deoksugung Palace, Seoul – Philip Jang on Unsplash.com

CHAPTER 3

Seoul Case Study

Utilizing Heritage Sites as Mitigation and Adaptation Instruments of Climate Change

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Introduction

Seoul has taken an integrated and synergistic approach of mitigation and adaptation to respond to climate change and continue ongoing efforts to achieve sustainable development. Most of the city's mitigation plans to prepare for climate change have focused on converting green environments into buffer zones. Simultaneously, the city's climate-change adaptation plan is also being carried out in a buffer zone to address the problem of heavy rain in urbanized areas using storage facilities in cultural heritage areas.

This chapter investigates how climate-change mitigation and adaptation plans are addressed using Seoul's heritage sites in managing and preserving built heritage, in support of Seoul's goal to create a healthy and safe city by increasing climate-change adaptation capacity. It demonstrates how cultural heritage can be used as a beneficial tool to respond to the ongoing climate crisis, and that actively protecting heritage places using cultural heritage to mitigate climate change is the correct approach.

The chapter asserts that cultural and natural heritage places can act as buffer zones to slow the impact of climate change, and that urban areas damaged by climate change can build natural resilience through the proliferation of cultural heritage zones.

Case study rationale and description

Case study rationale

Increasing population density and rapid urbanization have resulted in profound disturbance of the living environment and are primary factors in aggravating the threat of climate change.

Seoul's total population was just 2.44 million in the 1960s, increasing about 4.1 times to reach 10 million by 2022. There were only about 440,000 households in Seoul in the 1960s, yet that number increased dramatically to about 3.78 million households, an increase of 8.6 times, as of 2022, due to the trend towards more nuclear families living together in the same household. Due to such extreme population growth and urbanization, the urbanized area of Seoul is approaching 86%. Such conditions mean cities like Seoul are especially vulnerable to the threat of climate change.[1]

Cities sit at the forefront of climate action. Sustainable conservation of the global environment has been made through an urgent need to continuously maintain nature's circulation system—the interaction of soil, water, fire (sun), and air.

Culture and climate change have a dual relationship. The ecological systems for conserving the environment are interconnected and interdependent. A stable balance is critical for protecting the global environment.

There are negative impacts of climate change on cultural assets. Recently, an imbalance in this system is growing. The global annual average temperature from 2001-2010 was 12.8°C, about 2.1°C higher than the average temperature from 1911-1920. The 10-year average precipitation also increased by 287.2 mm during the same period.[2]

Seoul's target of a 40% reduction in GHG emissions below 2005 levels by 2030 remains unchanged. A 70% reduction by 2040 and carbon neutrality by 2050 are newly added targets. In addition, these targets expect that per-capita GHG emissions will decrease from about 4.7 tons/person in 2018 to about 3 tons/person in 2030. Even if Seoul implements this GHG reduction strategy for sectors such as buildings, transportation and waste by 2050, some emissions will remain as residual emissions (these remaining emissions are taken into account in the emission reduction scenario). These carbon offset projects are scheduled to begin in the mid-2030s and gradually expand thereafter. In 2050, about 20% of Seoul's

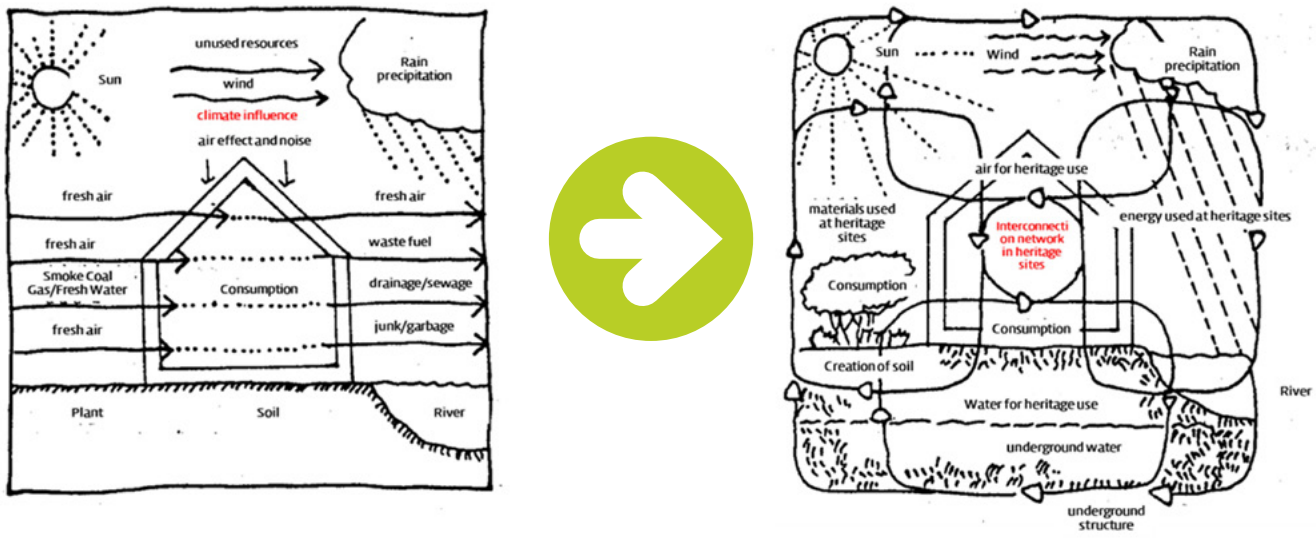
total GHG reduction required for carbon neutrality is planned to be offset through carbon credits.

Changes in each ecological system stemming from the climate crisis result in growing concerns that they could pose a larger threat to the global environment in the future. The ultimate goal to sustain the ecological environment through mitigation and adaptation of these climate change related changes is to make the built environment into an ecosystem (human-ecosystem) and organically link it with the natural ecosystem.

Over the past 60 years, Korea's population has rapidly moved from rural areas to urban areas, and urbanization has resulted in an increase in impervious areas (i.e. open water, wetlands, rock outcrops, barren ground) across most areas of the city. This has resulted in a change in runoff characteristics for rainfall in urban areas. When rainfall occurs, a large amount of rainwater rapidly flows into lowlands due to the infiltration of existing green areas and farmlands and loss of retention function. This causes overloading of drainage facilities such as rivers and sewers and is a major cause of urban flooding. In the case of Seoul, arguably the most rapidly urbanized area in Korea, the impermeable area was 7.8% in 1962, but increased to 49.4% in 2020. Looking at the rate of change in urban runoff due to rainfall, in 1962 evaporation was 43%, infiltration was 46%, and runoff was 11%. However, by 2020, the evaporation rate and penetration rate decreased to 25% and 23%, respectively, while the direct runoff rate through the road surface increased to 52%.[3]

The disturbance of the urban water cycle due to climate change is clear. The increase in the impervious layers and the increase in the occurrence of heavy rains in summer act as serious risk factors for disasters in urban areas due to storm, flood damage and heat waves. Heavy rains of 30 mm/hr or more in Korean cities increased from 3.4 times on average to 5 to 6 times per year, and the frequency of heat waves is high due to a temperature rise of 0.5°C or more on average over 10 years.[4]

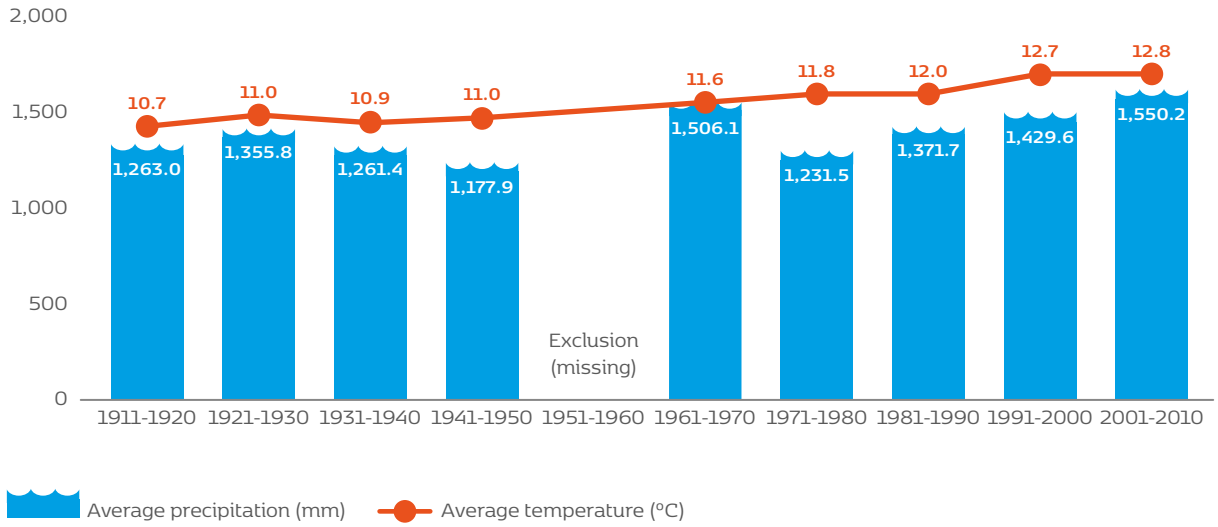
Figure 3.1 Comparing the existing built environment (left) to heritage-based built environment, which encourages sharing systems between nature and human society



Source: Author reconstruction of Krusche et. al. 2019, p. 20.

Average annual temperature on the Korean peninsula increased by 0.2°C per decade for 109 years (1912-2020), then by 1.6°C in the last 30 years, while the minimum temperature has increased by 1.9°C. The amount of precipitation has increased by 17.71mm in the last 30 years, the number of rainy days decreased by 2.73 days, and the possibility of localized heavy rain increased. The intensity of precipitation and the number of heavy rain days has also increased significantly, and the maximum daily precipitation, the highest 5-day precipitation, and the number of days in a year with the top 5% of precipitation also increased, resulting in an overall increase in the frequency of extreme precipitation. In the second half of the 21st century (2071~2100), the average annual temperature in Seoul is expected to increase by more than 4°C from 12.8°C to 17.1°C (Figure 3.2).

Figure 3.2 Projected average annual temperature and precipitation in Seoul, 2071~2100



Source: Climate Change Outlook Report, 2018, Korea Meteorological Administration.

To help address these trends, Seoul has set its vision as a "sustainable city where people, nature and the future coexist" and establish the goal of achieving a carbon-neutral city by 2050. In 2015 Seoul announced a promotional campaign, Seoul's Promise to Respond to Climate Change, enacted the Framework Act on Low-Carbon Green Growth for 2030, and introduced the emission rights system, a market-based GHG reduction system, in 2015.[5] In June 2015, Korea's Determined Contribution (NDC)—a target of a 37% reduction compared to the business-as-usual (BAU) 850.6 million tones—for 2030 was submitted to the Secretariat of the United Nations Framework Convention on Climate Change. Since then, the Enforcement Decree of the Framework Act on Low Carbon, Green Growth was amended in 2019, and the target has been revised to reduce by 24.4%, compared to 2017 levels, by 2030.[6]

By 2026, Seoul plans to transform 1 million old buildings into energy-efficient low-carbon structures that emit fewer GHGs as part of its countermeasures against climate change. Recently, the Detailed Implementation Plan for Climate Change Adaptation Measures (2022-2026) was enacted, followed by the Comprehensive Plan for Climate Change Response (2022-2026). New climate-change adaptation targets will be established by 2050 in line with these plans. To do so, the government plans to create climate-change scenarios to evaluate climate risks and establish short-term, mid-term, and long-term goals and schedules related to climate-change adaptation. Many countries are striving to reach net-zero emissions by 2050 to achieve the target of limiting an increase in global average temperature of 1.5° C set out in the 2015 Paris

Agreement, and Seoul is also trying to participate. The city's mitigation plans align with those of the international community.[7] In the past, the focus was on adaptation plans to cope with climate change, but recently, the international emphasis has changed to an integrated approach of adaptation and mitigation to respond to climate change and achieve sustainable development.[8]

Therefore, this chapter reviews how the Seoul Metropolitan Government and Korea's Cultural Heritage Association (CHA) are using cultural heritage as mitigation tools to reduce carbon, in line with international agreements on target-setting to respond to climate change. While Seoul and the CHA do not have any direct policy plan in place for mitigation and adaptation, they are currently in the process of submitting proposals for research and development projects. Sustainable technologies and techniques that actively utilize green heritage sites as buffer zones for future mitigation and adaptation can set a precedent for developing countries and can be applied by these countries through mutual exchange. Further, the initiatives discussed in this chapter may also be useful to sustainable tourism efforts already in progress worldwide to reduce carbon. It introduces five strategic models for mitigating and adapting climate change as indicated in the 2050 carbon neutrality goal promoted by the Seoul government and attempts to analyze in detail examples of applying cultural heritage sites as buffer zones for carbon neutrality.

Case study description

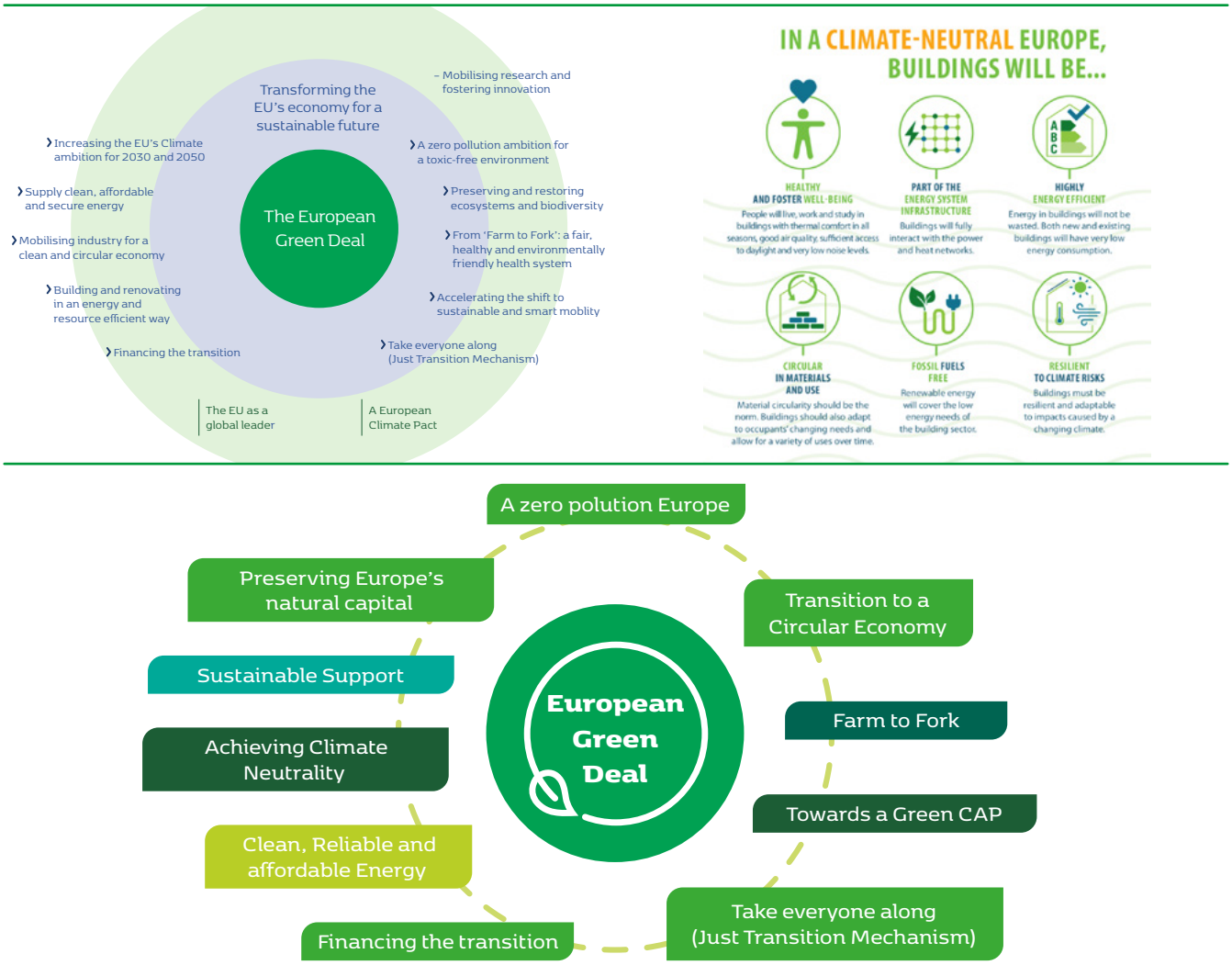
The 2050 Carbon Neutrality Goal promoted by the Seoul government establishes the role of cultural heritage through five strategic models: 1) green building, 2) green cycle, 3) green forest, 4) green energy and 5) green mobility. As part of this goal, the Seoul government is participating in the international community's efforts to limit the increase in global average temperature to within 1.5°C compared to pre-industrial levels through additional efforts. According to the Intergovernmental Panel on Climate Change (IPCC), to achieve the 1.5°C target, net GHG emissions must be zeroed by at least 2050.[9]

This case study suggests the possibility of using the five strategic models to alleviate and adapt to the climate crisis as well as to promote cultural heritage tourism. First, green building is consistent with green remodeling promotion based on the architectural heritage and heritage site. Second, the green cycle corresponds to the reuse of materials that occur in the repair work of cultural heritage. Third, the concept of the green forest can be linked to the restoration of the historical environment around the cultural heritage site. Fourth, green energy is closely related to the conversion to eco-friendly energy resources for heritage management facilities—for example, restoring abandoned streamlets by appropriating water reservoir systems against heavy rainfall in Hanyang Walled City. Finally, green mobility is exemplified by the city's creation of a forest path to the Tomb of the Kings of Joseon as a buffer zone for carbon reduction. Here, visitors can walk freely throughout the heritage area while the roadway is maintained and a tunnel over the road safely supports and restores some of the original forest path. In addition, the Seoul Metropolitan Government has invested funds and efforts to become an eco-friendly travel destination through the following cultural heritage sites: 1) Seoul Forest, 2) Cheonggyecheon Stream, 3) City Hall Green Wall, 4) Pureun Arboretum, 5) Seoullo 7017 overpass, 6) Jarakgil Trail (Ansan Mountain), 7) Naksan Park, and 8) Olympic Park.

Using Seoul's cultural heritage as a tool to counter emerging threats and challenges from climate change

The European Union has proposed to include cultural heritage as a climate-change mitigation policy in its European Green Deal. This is based on a 2021-2022 Europa Nostra collaboration with the International Council on Monuments and Sites (ICOMOS) and Climate Heritage Network to publish the European Cultural Heritage Green Paper, which suggests that cultural heritage can contribute to climate-change mitigation in conjunction with the European Green Deal. Recommendations outlined in the paper are in line with the goals of the Green Deal in the areas of clean energy, circular economy, energy efficiency, smart mobility, and an innovation wave for education and training. Europa Nostra predicts that cultural heritage can offer a culture-based strategy, such as the Renovation Wave and New European Bauhaus, to augment green deal policies that preserve European urban/rural landscapes.[10]

Figure 3.3 European Green Deal targets (top) plus recommendations for climate-neutral buildings in Europe by 2050 (bottom)



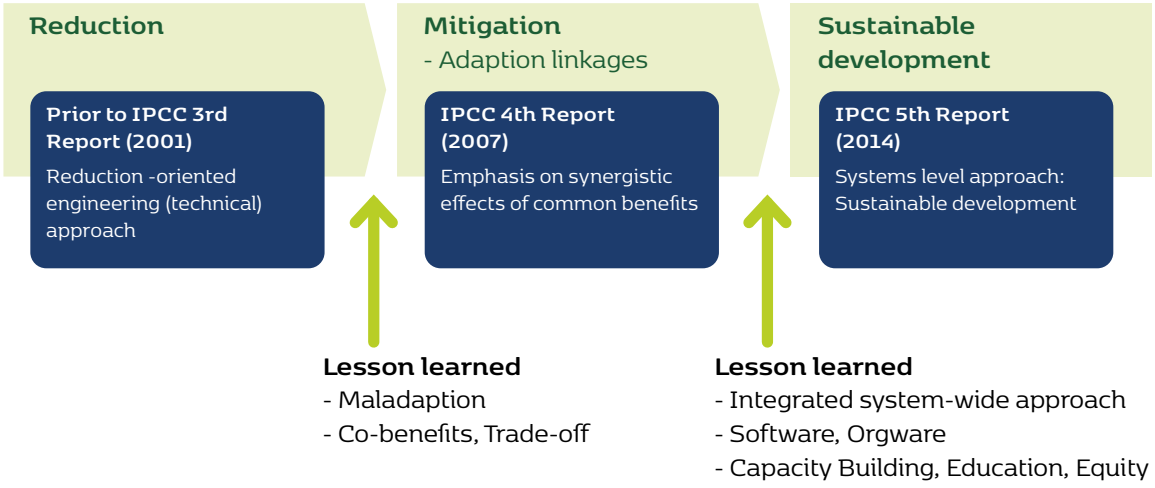
Source: Buildings Performance Institute Europe.

The international debate on climate change impact, adaptation and mitigation began in earnest after the IPCC's Third Assessment Report was published in 2001, and the concept of adaptation can be interpreted in several ways. First, ecological adaptation refers to the process by which organisms evolve to become better suited to their environment[11] and change to respond more effectively to their environment.[12] Adaptation also encompasses the behavior or process of taking advantage of new opportunities—in socio-economic terms—that arise as a result of climate change.[13] Climate-change adaptation is the adjustment of natural and human systems—including taking advantage of opportunities—in response to the climate crisis and its effects that are actually occurring or are expected to occur. Adaptation encompasses any action that enables communities and ecosystems to respond to changing climate conditions.[14] When it comes to cultural properties, including cultural heritage sites, adaptation can include: assessing the risk of climate change to cultural properties, monitoring the effects of climate change, installing disaster prevention systems to reduce the risk of cultural property disasters (landslides and forest fires), installing structures for preventive conservation, preserving the environment of natural monument habitats by installing artificial structures and water supply systems, and developing environmentally friendly treatment materials that can withstand climate change.

Climate-change mitigation is the reduction of future climate change. The IPCC defines climate change mitigation more specifically as "activities that reduce greenhouse gas emissions by reducing GHGs or increasing greenhouse gas sinks." Examples of such activities include using renewable energy, improving energy efficiency, conserving energy, planting trees, and separating and recycling waste. In the field of cultural heritage, mitigation initiatives include improving the energy efficiency of storage facilities through environment-friendly equipment, eco-friendly development plans—such as eco-friendly transport (electric vehicles) and green spaces (buffer zones)—passive protective pavilion design, and reforestation of excavation sites.

A 2016 report by the Korea Environment Institute (KEI) points to a recent change in the international policy direction regarding climate change, emphasizing an integrated, synergistic approach of both mitigation and adaptation to respond to climate change while achieving sustainable development.[15]

Figure 3.4 Link between GHG mitigation and climate-change adaptation strategies



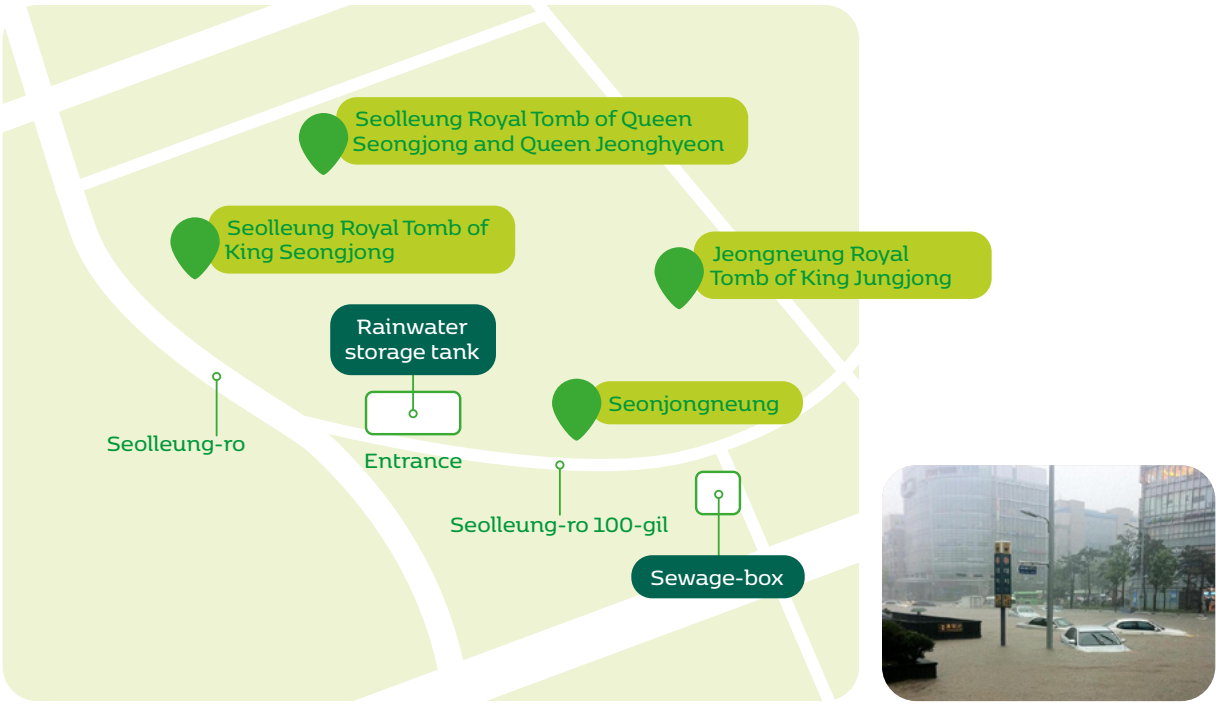
Source: KEI, 2016.

In general, most of Seoul's climate-change mitigation plans involve making green environments into buffer zones. Simultaneously, the city's adaptation plan also involves creating buffer zone to solve the heavy rain problem in urbanized areas through developing a rainwater storage facility within a cultural heritage area.

Seoul first established detailed climate-change adaptation and mitigation implementation plans in 2012. To achieve carbon neutrality, plans were set up for the following sectors, based on impact and vulnerability assessments: disaster and calamity, health, water management, forests, and ecosystems. Plans were based on Article 48(4) of the Framework Act on Low Carbon, Green Growth and Article 38 of the Enforcement Decree of the same Act (which governed climate-change impact assessment and establishment of adaptation measures). Based on the results of these sector-level impact and vulnerability evaluations, the Seoul government established a detailed comprehensive plan for adaptation measures tailored to Seoul's characteristics. Buffer zones for these mitigation and adaptation measures were mostly parks and green areas, even in mountainous areas where cultural heritage sites are located.

Most of Seoul's cultural heritage sites include green forest. One example of a climate-change adaptation initiative involving a buffer zone for building adaptation facilities is the installation of a rainwater storage tank in the basement of Seonjeongneung Tomb, which is located in the the perennially flooded area of Seomyeonneung. Seoul's Gangnam-gu Office met with Korea's Cultural Heritage Administration (CHA) more than 30 times over the course of two years before beginning the project in 2015. The CHA had originally opposed the installation of the storage tank on the grounds that the tomb area is a designated UNESCO World Heritage Site.

Figure 3.5 Rainwater storage(retention) tank and sewage box in Seongjongneung Royal Tomb, a World Heritage site, to mitigate flooding



Source: Original figure for this publication.

Roads and houses around the tomb have long been regularly flooded by rainwater and silt that accumulates in the tomb during heavy rains. The office argued that, since the area near the main entrance of the tomb was lower than Teheran-ro, an arterial road, it is more prone to flooding due to the inflow of water from the road. To prevent such flooding, the office planned to install a rainwater retention tank to trap rainwater in the parking area of the tomb (rainwater retention tanks trap rainwater that pours into an area all at once and outflows it gradually). As the custodian of the tomb, the CHA's reasoning for initially opposing the project was because it would alter the topography of the tomb and damage underground artefacts. The Gangnam-gu Office then requested the following: self-treatment of road water in the tomb and measures to reduce sediment runoff; installation of additional sedimentation facilities with insufficient capacity; and approval to install rainwater retention tanks in the car park area. The CHA response was that the tank would deform the terrain and damage the underground remains of the tomb, thus, it would be necessary to restore the ridge of the tomb through future excavations. The construction of such artificial facilities demonstrates a mitigation plan to overcome the climate crisis, while maintaining the environment without damaging cultural assets. Through continuous consultation and persuasion with the CHA, the Gangnam-gu Office was able to proceed with the rainwater retention tank, which was completed in 2016.

The project demonstrates a dual adaptation-mitigation purpose: the installation of water storage facilities to prepare for extreme weather is a climate-change adaptation activity, while the measures to reduce sediment discharge from the royal tombs to maintain a green buffer zone fall under mitigation. Constructing the adaptation facilities might have affected the heritage remains in the upper green ground; however, the mitigation buffer zones are likely to prove helpful in decreasing the risk to the heritage environment.

Figure 3.6 Relocation works of the reservoir sewage box in the Seongjongneung Royal Tomb, a World Heritage site

Source: Original figure for this publication.

Strategies, responses and actions: Application of cultural heritage as a tool for climate-change mitigation and adaptation in Seoul

Current responses to climate change promoted by the Seoul government lack a concrete position to protect cultural heritage. This would require overcoming technical barriers such as limited understanding of current and future climate change vulnerability and risks to diverse heritage types. In order to overcome these technical barriers, heritage experts should begin by considering the development of targeted and site-specific vulnerability and risk assessments that are sensitive to the specific characteristics of heritage types and values. As such, vulnerability or risk assessments need to move beyond assessing only exposure to climate-change risks and towards integrating the assessment of heritage sensitivity and relative importance of the range of potentially feasible climate-adaptation measures.

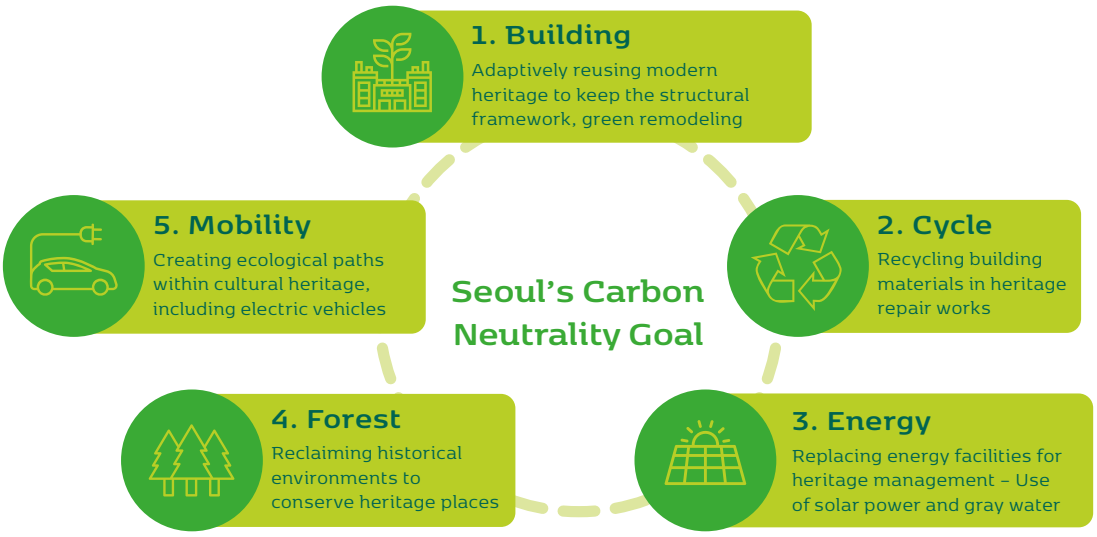
If cultural heritage sites are to be used to address the impact of climate change, climate-change mitigation and adaptation initiatives share the best approaches. Both methods are closely linked. For example, rooftop greening provides structural protection for the roof layer of a building, but it can also reduce the heat island effect through green spaces. Furthermore, it helps to preserve cultural heritage in a sustainable way and can be developed as a new tourism resource—as a space of historical significance and for healing. Importantly, methods like rooftop greening must be practically implemented at a low cost.

In addition to considering real economic issues, the success of Seoul's climate-change mitigation and adaptation plans—taking into account the goal of being carbon-neutral by 2050—depends on city residents' strong awareness of climate-change issues. As mentioned earlier in the chapter, to achieve carbon neutrality by 2050 Seoul has set policy goals in five areas: 1) green building, 2) green mobility, 3) green cycle, 4) green energy, and 5) green forest. Specific action plans for each area have also been prepared.

In terms of green building, the city's core goal is to convert all buildings in Seoul into low-carbon, zero-energy buildings. In the transport sector (green mobility), all internal combustion engine vehicles are to be converted to zero-emission vehicles, such as electric vehicles and hydrogen vehicles; eco-friendly transportation infrastructure conversion to promote walking and bicycle use is another key objective. The green cycle policy is designed to fundamentally reduce waste generation, promote recycling of generated waste, and prohibit direct landfilling. In the energy-supply sector, the goal is to convert fossil fuel-based electricity into renewable energy-based electricity, such as via solar power and hydrogen fuel cells. Finally, Seoul's green forest policy proposes to expand urban parks and forests to offset GHG emissions and improve the resilience of cities. All five of these strategies can be realized through the appropriate use of cultural heritage (Figure 3.7):

1. Green building: adaptively reusing modern heritage to maintain the structural framework; green remodeling
2. Green cycle: recycling building materials in heritage repair works
3. Green forest: reclaiming historical environments to conserve heritage places
4. Green energy: replacing energy facilities for heritage management
5. Green mobility: creating ecological paths within cultural heritage, including electric vehicles

Figure 3.7 Cultural heritage as a tool for mitigating and adapting to the climate crisis



Source: Original figure for this publication.

Five strategic models, with examples

Seoul is at the forefront of the "smart city" movement, aiming to merge technology with urban development. This appetite for innovation makes Seoul more open to creative urban projects, and green building construction is consistent with the green remodeling promotion of heritage places. Analysis of carbon emissions based on data from NASA's carbon observation satellite (OCO-2) has revealed high carbon emissions in Seoul's Gangnam-gu area. In Gangseo-gu district, the actual observed value was higher than the GHG inventory-based estimate, while in the Yeongdeungpo-gu and Gangnam-gu districts, the observed value was lower than the estimate. What's surprising is that direct emissions were higher than Seoul's indirect emissions. Direct emissions refer to GHGs that are directly emitted when used, such as from power plants, boilers and vehicles, while indirect emissions refer to GHGs that are not directly emitted when used as electricity but are emitted when produced. Direct emissions are thought to be high in areas with power plants and indirect emissions high in large cities; but direct emissions are also high in the Seoul metropolitan area. In this respect, remodeling of cultural resources and office buildings supported by the preservation of cultural heritage sites is considered necessary.[16]

This difference in GHG emissions in Gangnam and Gangseo is not only due to the awareness, interest, and consciousness of their respective residents, but also to differences in population density, investment costs, amount of green space, and the way in which cultural heritage sites are managed. This means that the vulnerability of cultural heritage differs across areas, and that there are regional differences in overcoming these vulnerabilities and utilizing cultural heritage as a tool for climate-change mitigation and adaptation. The Seongjongneung Royal Tomb, discussed in the previous section, is located in Gangnam-gu district. For the site to operate as a beneficial tool for carbon reduction, it is necessary to plant much many carbon-reducing trees than the existing royal tomb areas to see any effect.

Rooftop greening not only serves as a shelter in the city center for citizens, but also has a variety of other effects, including mitigating the heat island

phenomenon, reducing cooling and heating energy, and providing habitats for animals and plants. Since Seoul's rooftop greening project began in 2002, the Seoul Metropolitan Government has created green spaces on the rooftops of a total of 785 public and private buildings. When the government compared the surface temperatures of a roof section with and without rooftop greening from June to November 2020, the section with rooftop greening showed an average temperature reduction effect of -3.1 . On average, buildings with rooftop greening reduced energy consumption by 12-15%, with energy savings of up to 17% when the outside temperature was above 35 . In addition, the analysis showed that rooftops with 100 of greened fields 10cm deep could store about 200ℓ of rainwater, which could play a role in preventing urban flooding by slowing down stormwater runoff rate. Rooftop greening also provides habitat for flora and fauna. Seoul's on-site monitoring of 79 rooftop green spaces created in the last five years found that 14% of them had at least five more species of insects and birds than they had before.

Although there are no direct laws and regulations related to the creation of rooftop gardens, laws and regulations related to rooftop landscaping—the legal basis for rooftop gardens—include the Building Act and Enforcement Decree and local government building codes. According to Article 42 of the Building Act, Article 27 of the Enforcement Decree of the Building Act, and the building regulations of local governments such as Seoul, to build on a site with an area of 200 requires securing a landscape area according to the use area, scale of the building, and gross floor area. Depending on the building area, it is essential to secure the landscaping area. However, this is more difficult in high-density areas, such as downtown areas. According to Article 27, Paragraph 3 of the Enforcement Decree of the Building Act, an area equivalent to two-thirds of the landscape area of a rooftop can be calculated as a landscape area to meet the statutory requirements of a "landscape area". In addition, through the enactment of a local ordinance, the Seoul Metropolitan Government increased the subsidy rate for rooftop greening for autonomous districts, public institutions and private buildings from 50% to 70% to encourage business participation, and in the case of private buildings, supported the selection and construction of a rooftop greening company in consultation with building owners.

At a press conference in April 2022 at Sewoon Hall in Cheonggyecheon-ro, Seoul Mayor Oh Se-hoon proposed a strategy to reinvent the city center as a "green ecological city" where skyscrapers and tree groves coexist, full of vitality and space, and where growth had long been stagnant and desolate. He stressed that while the world's largest cities have developed their urban centers with the idea of securing skyscrapers and abundant greenery at the same time, Seoul's city center had not been able to shed its backwardness due to inflexible preservation-oriented policies over the past decade. The idea behind the mayor's strategy is to drastically relax regulations on building height (below 90 meters) and floor area ratio (below 600%) according to Seoul Metropolitan Government's current regulation. In return, private developers will receive public contributions to create parks and green spaces. A detailed plan was also presented to create at least one park per block, then connect the parks with green walkways, spreading the greenery to neighboring areas to create a green network that circulates throughout the city center. The city estimates that this will raise Seoul's urban green space rate to more than 15%, from the current 3.7%.

Significant attempts have been made to not only secure under-utilized green space within the urban center, but to also form an ecological network linked with neighboring green areas such as sports parks and roof gardens. In response to climate change, the city has promoted various types of artificial ground greening projects, including Seoullo 7017 (an overpass), Donuimun Museum Village Vertical Garden, and various rooftop greening gardens. As part of the first initiative, the Seoul Government created a green space on the roof of a newly constructed train station in connection with the old Seoul Station, a nationally designated historic building to be completed as a complement to Seoul's Cheonggyecheon river restoration project. Between the rooftop of the Seoul Station and the street of the Seoullo 7017 Overpass, an open-air garden is to be created around the closed parking ramp that has been neglected for 20 years—although public calls for its removal had mounted after a safety

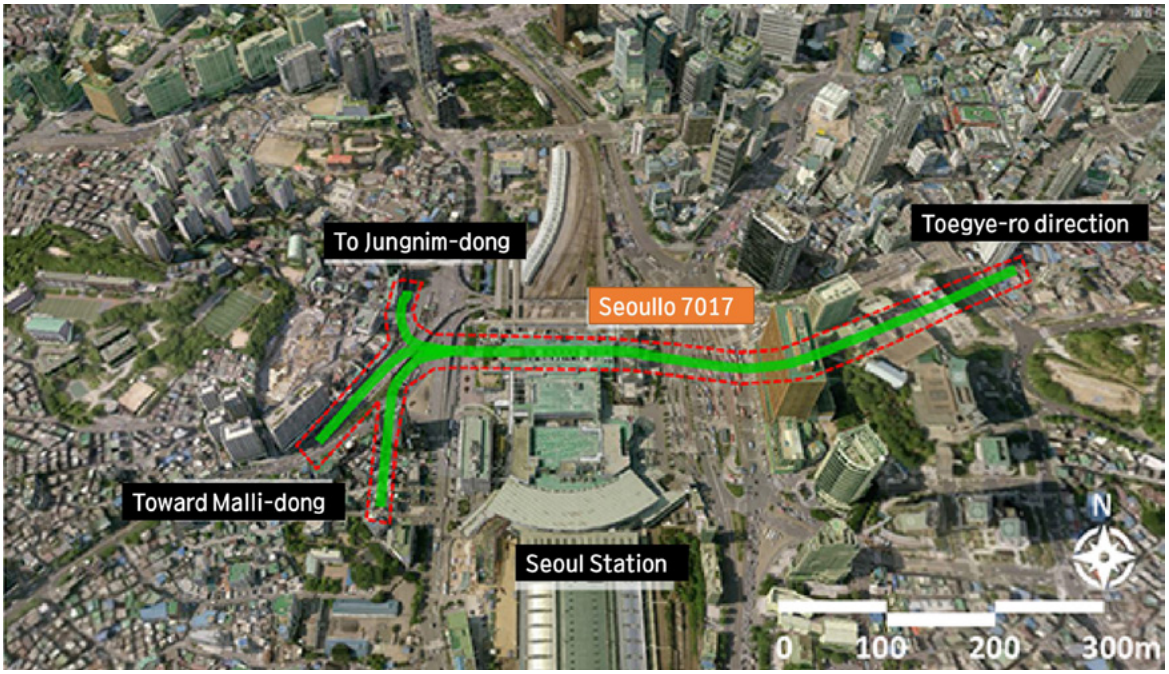
assessment classified the outdated structure as dangerous in 2006.[17]

In Donuimun Museum Village, the Vertical Garden has been made to form an ecological network linked with neighboring green areas such as sports parks and roof gardens.

Photo 3.1 Vertical Garden at Donuimun Museum Village, an ecological network linked with neighboring green areas

Source: Author.

Figure 3.8 Seoullo 7017 Overpass



Source: Original figure for this publication.

Photo 3.2 Seoullo 7017, 1970-2020, prior to (top) and post (bottom) green remodelling, with structural reinforcement

Source: Seoul Metropolitan Government, 2017a.

The Seoullo 7017 overpass gets its name from the numbers that represent its transformation—from a traffic road in the 1970s to a sky garden in 2017. The elevated one-kilometer path is lined with 24,000 plants and is similar to Paris City's Promenade plantée and New York City's High Line. Seoullo 7017 was the realization of the winning design, by Winy Maas of the Netherlands, in the Seoul Arboretum competition, and puts forth the concept of an urban nursery, growing trees and plants for replanting elsewhere in the city.[18] The pre-Seoul Station overpass was constructed in 1970 as a response to growing traffic congestion in Seoul. Seoullo 7017 sets the elevated road as a combination aerial garden and botanical garden and equates the overpass to a single large tree, leaving open the possibility of spreading and connecting the greenery to the surrounding area. Seoullo 7017 is composed of an upper part, the main pedestrian road, Malli-dong Plaza, and a traffic island. Circular concrete plant pots (645 pots in total, of 66 types) were installed on top of the overpass. Collectively, the planters act as an artificial ground greening system that applies a landscape-standard tree growth soil core (90cm for trees, 60cm for large shrubs, and 40cm for small shrubs and herbaceous plants), with soil that takes into account the growth characteristics of each plant. Planters are designed to regulate and supply moisture to the soil layer and include a drainage plate that can store rainwater.

Photo 3.3 Seoullo 7017 walkable path, post green remodelling

Source: Author.

The Gyeongui-Gyeongchun Line Forest Park, transformed by the Seoul Metropolitan Government from a disused railway line into a green linear park, is a green forest initiative that has grown into a local attraction in a short period of time, attracting an average of 33,000 visitors a day—25,000 for the Gyeongui-Gyeongchun Line Forest Park and 8,000 for the Gyeongchun Line Forest Park—and bringing new vitality to the area. According to the Seoul Metropolitan Government, the expanded green space created by the two urban forests is the size of 22 football fields (157,5188m^2). According to the Korea Forest Service, the forests act as lungs in the city, reducing the amount of fine dust emitted by 165 diesel cars per year (277kg in total). In addition, the temperature of the forest road is also measured to be 10°C lower than the surrounding area, confirming the park's effectiveness in mitigating the heat island phenomenon. The Gyeongui-Gyeongchun Line forest path has also been shown to increase biodiversity and restore the ecosystem.[19]

Figure 3.9 Gyeongui-Gyeongchun Line Forest Park, various images

Source: Original figure for this publication.

The Gyeongui-Gyeongchunseon Forest Park Project Effectiveness Analysis study confirms the impacts of urban forests in reducing fine dust, alleviating the urban heat island phenomenon, and restoring ecosystems. The study also concluded that urban forests are revitalizing the local economy. The environmental and ecological evaluation section of the study indicated that project demonstrated a greenery rate of 53.3%, a water permeability rate of 59%, and an ecological area rate of 55.07%, indicating that the health of the urban ecosystem is enhanced by improving the water circulation system, enhancing the landscape, reducing fine dust, reducing urban heat islands and improving biological habitat functions. According to the temperature survey section of the study, it was found that the thermal temperature was 10 degrees higher in areas with high tree density compared to areas with low tree density.[20]

Photo 3.4 Gyeongui-Gyeongchun Line Forest Park

Source: Author.

The green cycle refers to the reuse of materials generated in the repair work of cultural heritage. Just as important are the economic factors that enable the implementation of strategies to mitigate climate change. Yet, knowledge gaps in the built heritage sector are a clear barrier to working to mitigate climate change. More research is needed to test the use of modern materials during the refurbishment of historic buildings and on the traditional behaviors and characteristics of historical buildings. Another significant barrier is the progressive loss of traditional skills and techniques; adopting solutions that are incompatible with the behavior of historical materials can accelerate their degradation. The development of climate-change adaptation strategies should therefore consider the balance between decay reduction and energy consumption in the improvement of historical buildings. Best-practice examples in mitigating climate change include refurbishment measures to increase the energy efficiency of historical buildings in relation to upgrading the insulation, ventilation, lighting, and heating, as well as the monitoring of climatic conditions. Insulating floors, ceilings, roofs and walls reduces heat loss through windows by adding secondary glazing and using curtains, shutters and blinds. Ventilation in historical buildings to avoid condensation can be done by using mixed mode or hybrid ventilation systems, with mechanical devices improving the natural ventilation of buildings in a controlled way, or by passive ventilation using traditional systems such as wind chimneys and louvers.

New construction is the biggest factor inducing climate change by increasing carbon emissions due to concrete curing and steel structure construction. Therefore, the continuous reuse of existing buildings plays an important role in mitigating climate change through carbon-emissions reduction by replacing minimal building materials. In particular, in the case of cultural heritage, reuse of materials can make

a great contribution to mitigating climate change through adaptive reuse. To maintain the value of cultural heritage, the usability of the building can be increased by expanding the necessary space outside the building and removing unnecessary space inside the building.

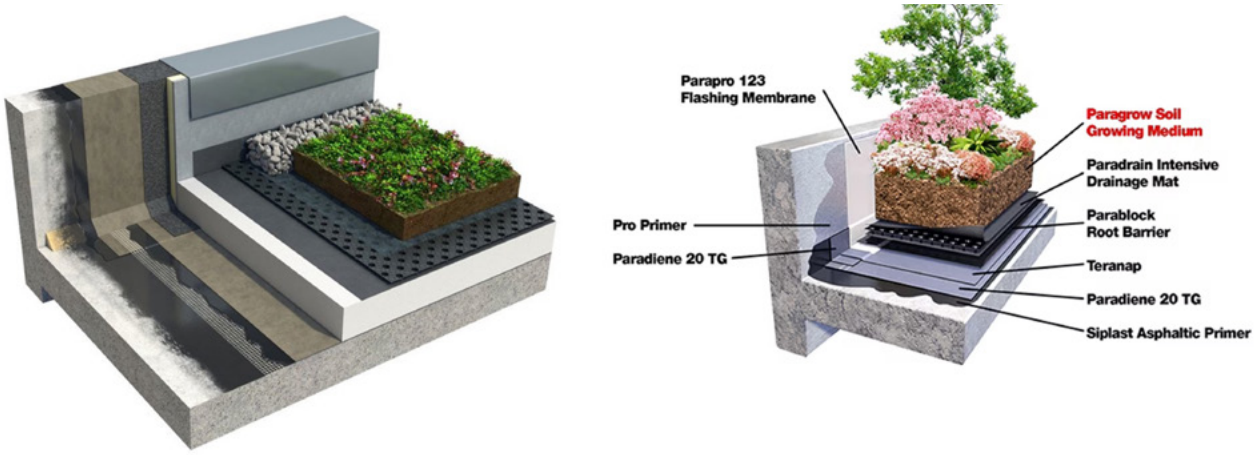
Conversely, most of these buildings have weakened structures due to deterioration, so their structures can be reinforced in preparation for landslides and floods led by heavy snow, heavy rains and strong winds. Carbon reduction through minimizing new construction and maximum reuse of existing buildings is the most efficient way to mitigate and adapt to climate change. The cases of Yongsan Railway Hospital and Dilkusha are introduced in the next sections as suitable examples for mitigating and adapting to climate change.

The Yongsan Railway Hospital, built in 1928, was reborn as the Yongsan History Museum when it opened on March 23, 2022. The museum has a total area of 227m^2, consisting of exhibitions, educational spaces and office space. The main building of Yongsan Railway Hospital was designated as a national registered cultural property in 2008 in recognition of its value as a modern building with a history of more than 100 years. The red bricks of the exterior walls of the Yongsan History Museum do not look much different from those of the old Yongsan Railway Hospital, as the building was renovated in a way that preserved the building as much as possible without damaging it. For example, there is an eye-catching stained-glass entrance door. The rooftop of the original Yongsan Railway Hospital was used as a walkway for patients. Now, a rooftop garden with plaza decks and green roof installations protects the top slab from heavy rainfall, applying the Parabit Solo Hot Melt Waterproofing System, which is a durable and flexible waterproofing membrane that is applied with heat and manufactured from a blend of bitumen and SBS polymers.

Photo 3.5 Rooftop gardening of the former Yongsan Railway Hospital

Source: Author.

Figure 3.10 Siplast Green Roof System applied to the former Yongsan Railway Hospital



Source: Original figure for this publication.

The rooftop was originally used as a walkway for patients. Reinforcement of the building was completed by recreating a great truss structure with the H-beam; reusing the brick materials, terrazzo floors or walls (a composite material commonly used for floor and wall treatments); as well as using reinforced concrete structures such as columns and beams. Conservation principles were determined based on the current state of the building. In principle, the degraded part should be restored to its original state at the time of construction. However, if the rationale is unclear, the current state is maintained. The original shape of the building was restored as much as possible in consideration of the exhibition effect of the building itself, not just the exhibition of artefacts inside. However, in cases where modifications were unavoidable, they were kept to a minimum to adhere to current laws and regulations

Photo 3.6 Application of original bricks and structures to represent the original state at the Yongsan Railway Hospital

Source: Author.

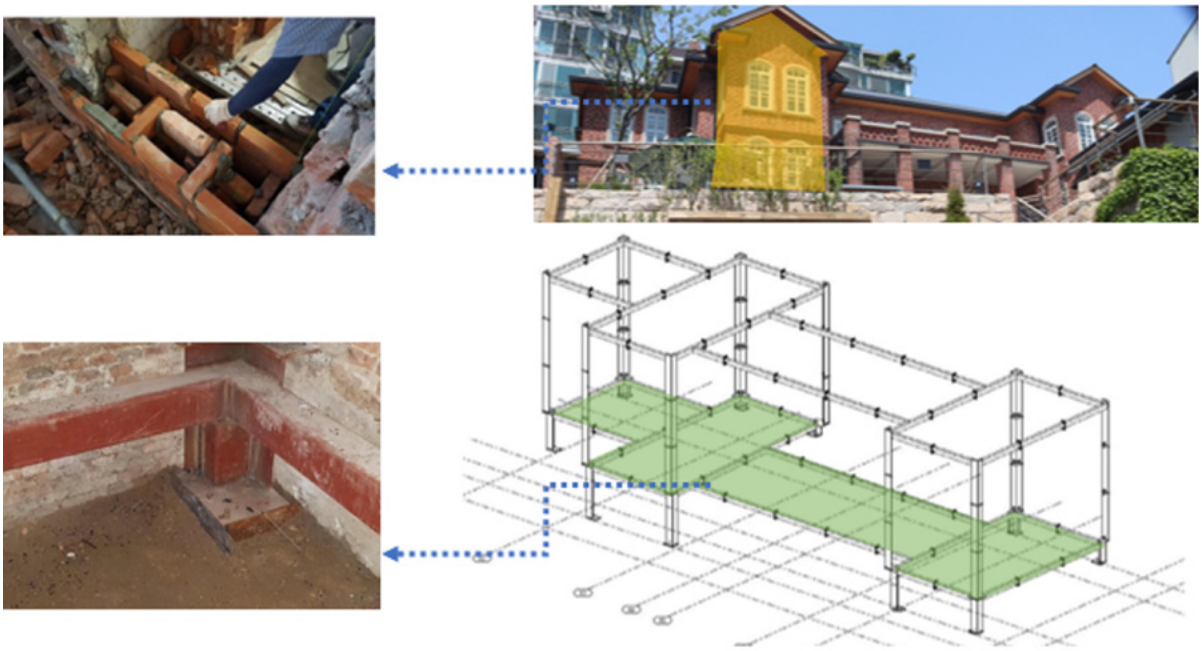
Another representative case of a green cycle initiative on a cultural heritage site is Dilkush House. The house was completed in 1924 by Albert and Mary Taylor who started construction of the house in 1923, then rebuilt it after a fire in 1926. Albert Taylor was an American journalist reporting on Korean life during the Japanese occupation. After the Taylors were banished from Korea by the Japanese imperial authorities in 1942, the house fell into disuse and disrepair. To restore Dilkusha to its original form, the Seoul Metropolitan Government entered into a business agreement with the Ministry of Economy and Finance, the CHA, and the Jongno-gu Office in 2016, and "Albert W. Taylor's House (Dilkusha), Seoul" was designated a Registered Cultural Heritage in August 2017.

Academic researchers, architects and designers then began to restore Dilkusha and turn it into an exhibition hall. Construction to restore the original form of the building started in November 2018 and was completed in December 2020. In particular, the living room was restored to how it looked when occupied by the Taylors. Improvements to the insulation of the building envelope is a major theme in climate-change mitigation, and there are several options to choose from, including recently advanced options, along with evidence for their varying effectiveness. For Dilkusha, to reuse the interior and exterior wall bricks and flooring materials, building designers chose to extend the usability of the building by reinforcing the H-beam and C-beam to support the structurally vulnerable building framework.

Photo 3.7 Post-repair of Dilkusha heritage site

Source: Author.

Figure 3.11 Reinforcement of the H-beam and C-beam for the structurally vulnerable building framework at Dilkusha heritage site



Source: Seoul Metropolitan Government, 2021.

Photo 3.8 Conservation works of Rat Trap bond to maintain insulation function and structural stability

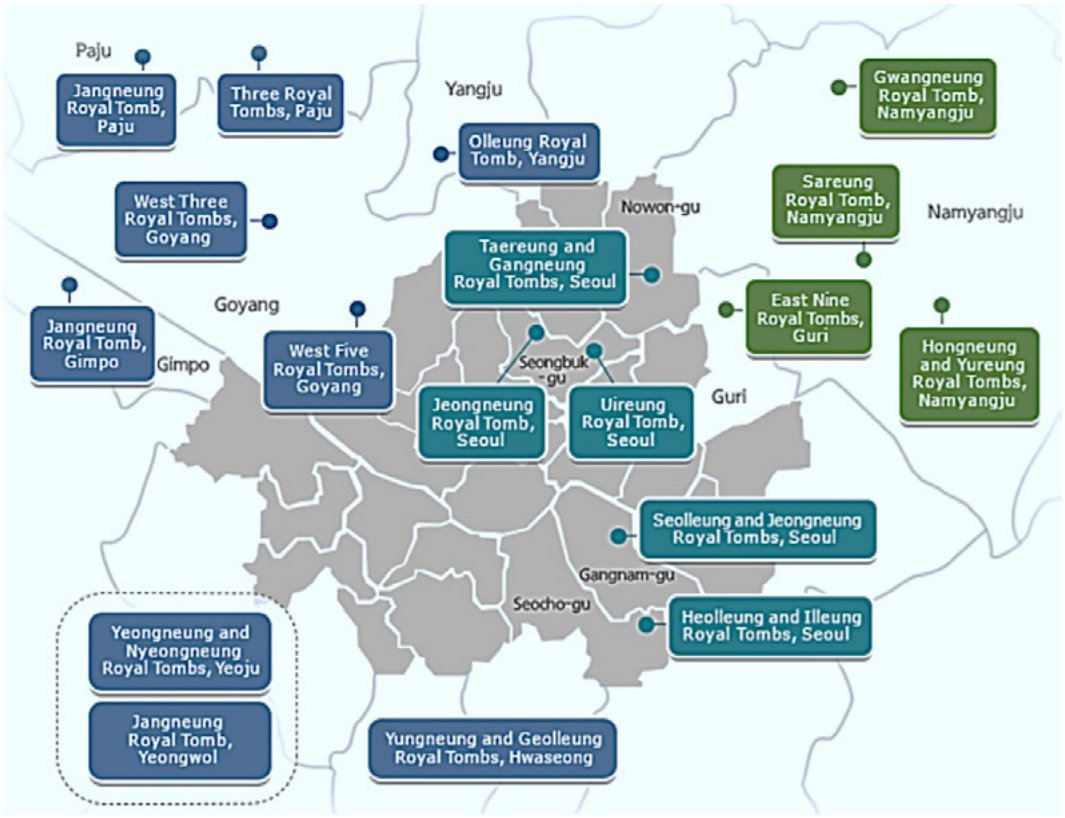
Source: Seoul Metropolitan Government, 2021.

The brickwork of Dilkusha is unlike any other existing example of modern architectural heritage. The bricks are 225×110×50 mm, larger than current brick sizes (190×90×57 mm on average). The Flemish bonds along with the hollow wall bonds are applied by erecting a stretcher. These are slso known as Rat Trap bonds, although the terms "cavity walls" or "hollow walls" are commonly used interchangeably. Dilkusha's Rat Trap bond shows the header faces intersecting, unlike the traditional English bond method where the headers are laid at regular intervals in each course. In terms of edge treatment, the conventional method is to finish the header face with two layers of bricks, while the Dilkusha method is to finish the header face with one layer of bricks. This is used to maintain insulation function and structural stability.[21]

In cases such as the renovation of Dilkusha House, the principle focus is on restoring the altered areas to their original condition. Reusing existing materials and using traditional construction techniques was the optimal choice for the mitigation plan to achieve carbon neutrality. To compensate for potential structural support issues, the structure was reinforced with new steel beams and additional walls were erected to improve thermal insulation. In addition, rooftop gardens were installed and double-glazed windows were replaced to complement the insulation performance of the entire building. These measures could be considered an adaptation plan for climate change.

Therefore, climate-change mitigation and adaptation planning can be integrated into the repair and restoration of modern registered cultural properties. These examples show that they should be a routine part of any construction method for all modern architectural cultural properties.

Figure 3.12 Location of Joseon Royal Tombs



Source: Joseon Royal Tombs website (translated into English).

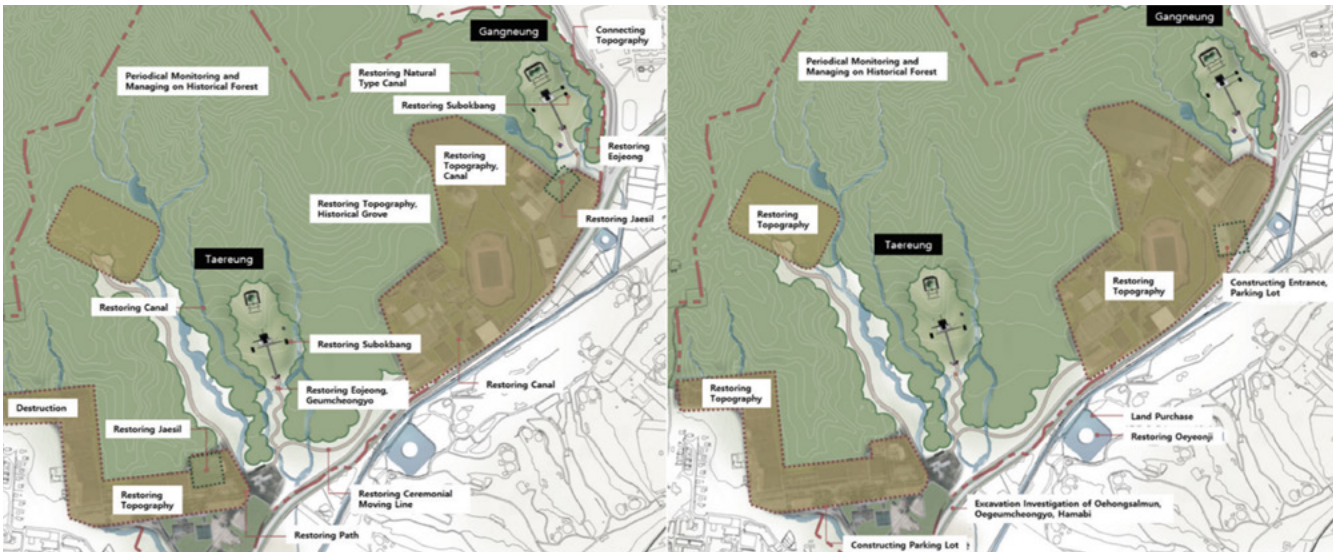
The **green forest** concept is linked to the restoration of the historical environment surrounding a cultural heritage site. A recent study found that the amount of carbon absorbed annually by Seoul's palaces and royal tombs is equivalent to the amount generated by traveling 5,000 times between Seoul and Busan in a car. Satellite data analysis from 700 km above Seoul found that the amount of carbon absorbed by Seoul's four palaces and the Jongmyo Shrine reached 150 tons per year, equivalent to the amount of carbon emitted when using about 200,000 tons of gasoline. Results were calculated by inserting the type, amount and volume of trees into a carbon absorption calculation formula. Changdeokgung and Changgyeonggung Palaces absorbed 103.2 tons of carbon per year. Jongmyo Shrine absorbed 26.88 tons, Gyeongbokgung Palace 15.66 tons, and Deoksugung Palace 3.98 tons. In addition, the research states that carbon was absorbed by the effects of trees, some hundreds of years old, and grasses growing inside and around the neighboring heritage places, as well as by the soil, forests and fallen plants that support them. Analysis also indicated that the wooden building itself contained a large amount of carbon because the heritage and surrounding area absorbed carbon.

As part of a restoration project involving the royal tombs, tree-forested areas were planted to match the sacred and romantic landscape of royal tombs near the Korea National Training Center for Sports. Trees were also planted on the grounds of the sports center. The sports center is situated between two of the royal tombs—Taereung, the tomb of Queen Munjeong, the second wife of the 11th Joseon king, Jungjong, and Gangneung, the tomb of Queen Munjeong's son and the 13th Joseon king, Myeongjong and his wife, Queen Insun. The sports center has been managed by the Korean Olympic Committee. In June 2009, all 40 of the royal tombs of the Joseon Dynasty were designated UNESCO World Heritage sites. All buildings within the 40 tombs have been dismantled or relocated outside the tombs, and forests planted around them. In the same manner, after being registered as a World Heritage Site, the buildings within the Taereung Royal Tomb were disassembled and the restoration of related facilities to the Taereung began (Lee and Jung 2022).[22]

Photo 3.9 Before (left) and after (right) restoration of forest areas around the World Heritage Sites Taeneung and Gangreung, Royal Tombs of the Joseon Dynasty

Source: Author.

Figure 3.13 Before (left) and after (right) restoration of forest areas around the World Heritage Sites Taeneung and Gangreung, Royal Tombs of the Joseon Dynasty

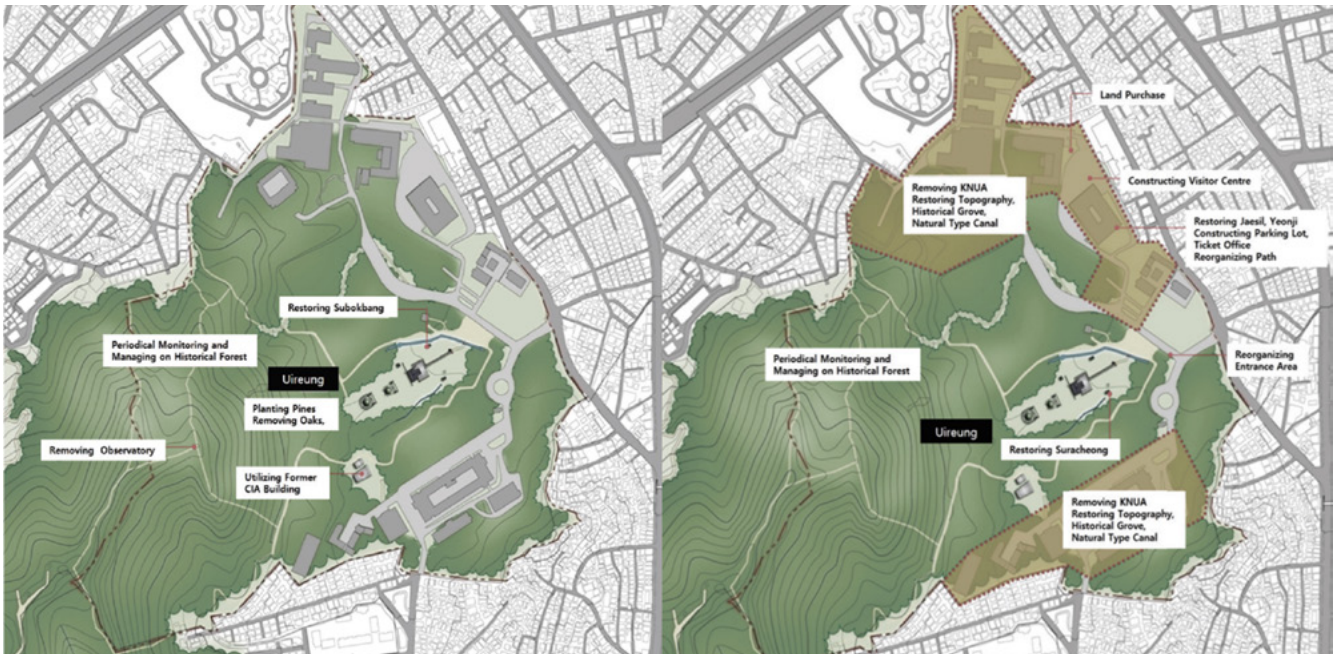


Source: Original figure for this publication, based on Choi et. al. 2017; CHA 2015; and CHA 2021.

Photo 3.10 Before (left) and after (right) restoration of Uireung Royal Tombs of the Joseon Dynasty (see A, C, and E areas for details of new forested areas)

Source: Author.

Figure 3.14 Topographical map depicting before (left) and after (right) restoration of Uireung Royal Tombs of the Joseon Dynasty



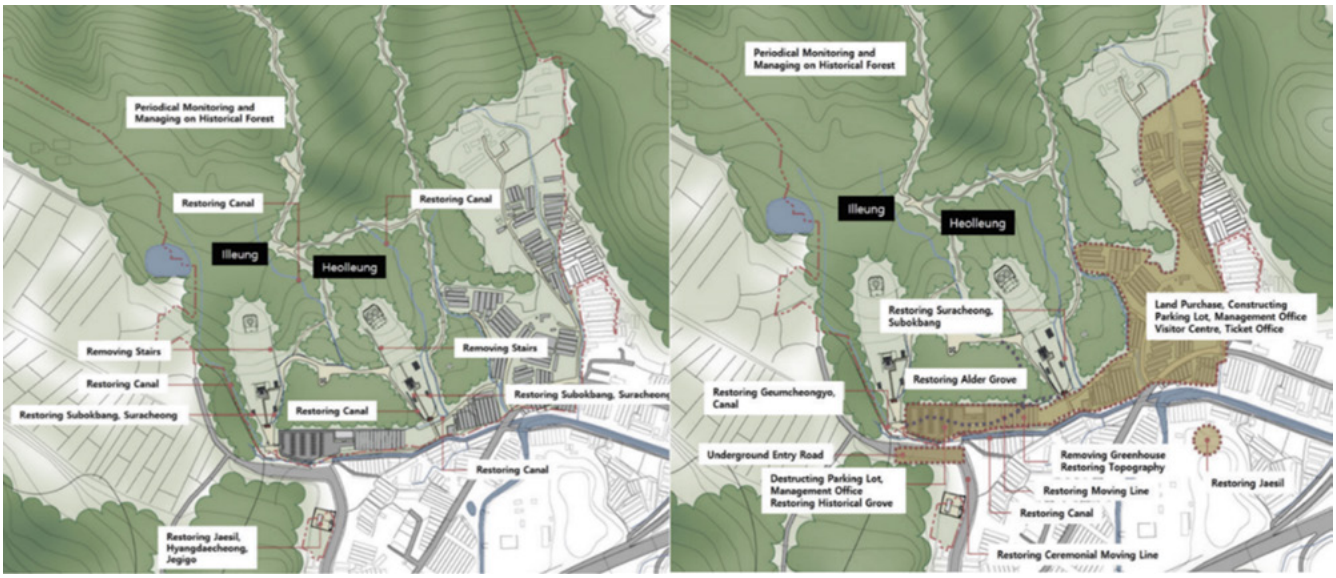
Source: Original figure for this publication, based on Choi et. al. 2017; CHA 2015; and CHA 2021.

Uireung, the site of the royal tombs of King Gyeongjong, the 20th king of the Joseon dynasty, and his wife Queen Seonui, is located inside Seokgwan-dong campus of the Korea National University of Arts. In 2003, the CHA conducted an extensive excavation survey of the Uireung area. At that time, only the original pavilion and monument remained, but the excavation team later unearthed the remains of Subokbang, the janitor's quarters, and Suragan, the kitchen. After that, a master restoration plan was established to relocate the campus to a newly-constructed campus.

Photo 3.11 Before (left) and after (right) restoration of the Heonlleung and Illeung Royal Tombs of the Joseon Dynasty

Source: Author.

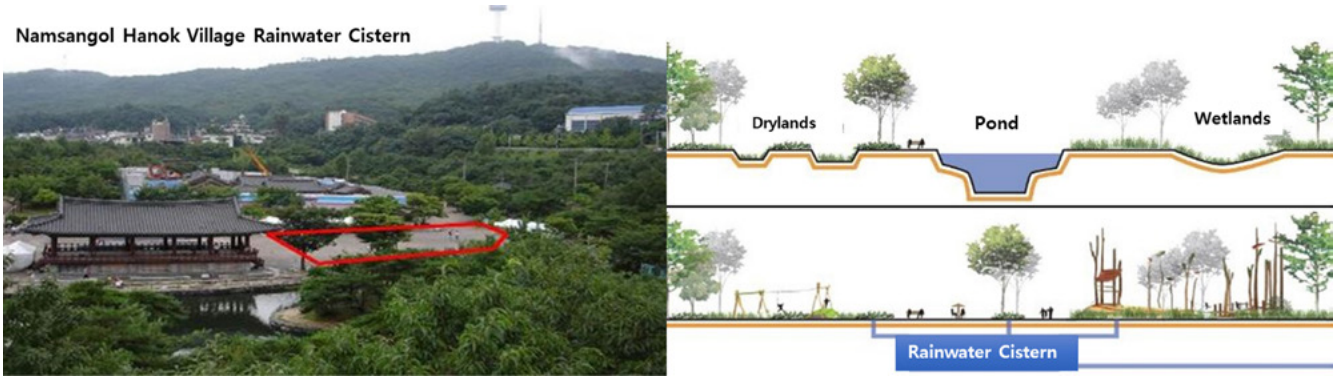
Figure 3.15 Topographical map depicting before (left) and after (right) restoration of Heonlleung and Illeung Royal Tombs of the Joseon Dynasty



Source: Original figure for this publication, based on Choi et. al. 2017; CHA 2015; and CHA 2021.

Finally, the Heolleung tomb of King Taejong, the third monarch of the Joseon Dynasty, and his consort Queen Wongyeong, and Illeung, tombs of King (Honorary Emperor) Sunjo and his consort Queen (Honorary Empress) Sunwon were renovated after designation as a World Heritage site. Buildings located around the tombs were removed and the empty space recreated as a green forest environment.

Figure 3.16 Green energy project combining climate-change mitigation and adaptation: Namsangol Hanok Village rainwater reservoir



Source: Original figure for this publication.

Green energy is closely related to environment-friendly energy conversion for heritage management facilities. One example of a green energy project that incorporates both climate-change mitigation and adaptation involves the development of a rainwater retention tank to protect Seoul's Hanyang Walled City from runoff from heavy rainfall from nearby Mt. Namsan. A rainwater retention tank is a facility that temporarily collects a large amount of rainwater that flows down to lowlands at a high speed during

heavy rainfall, and then releases that water so it flows out gradually. In terms of mitigation, a lot of water generated by heavy rain is stored in the retention tank, treated to support the water supply, then used to restore the old streamlets in Mt. Namsan. These measures are designed to minimize the impacts of gradual variations in temperature, precipitation and wind on outdoor heritage by restoring waterways to minimize GHG emissions. They have the added effect of decreasing the impacts on river floodplain heritage sites in Namsan Moutain area and overflooding around Cheonggyecheon Stream.

Figure 3.17 Climate-change mitigation: Restoration of abandoned streamlets, formed in pre-modern era, using a water reservoir system against heavy rainfall in Seoul's Hanyang Walled City

Source: Original figure for this publication.

In terms of climate-change adaptation, the Namsangol Hanok Village Rainwater Cistern, installed in Namsangol Hanok Village at the end of 2008 and covering an area of 1219m^2, contains 6,978 tons of rainwater and releases it gradually, minimizing flooding damage to the downstream area of Pil-dong as well as the area around Cheonggyecheon and low-lying areas during the rainy season. At the end of October 2010, a rainwater retention tank was installed at the Pil-dong Residents' Playground, adjacent to the Namsan North Ring Road, to prevent a large amount of rainwater from flowing into Cheonggyecheon. In 2012, an additional tank with a capacity of 3,500 tons of rainwater was installed at Dongguk University's sports field, also in the Pil-dong area, The total amount of rainwater that can be stored in the three rainwater storage tanks is 16,896 tons. The rainwater storage tanks at Namsan Mount Reservoir and Namsan-gol Hanok Village were praised for preventing overflooding around Cheonggyecheon Stream, unlike the Gwanghwamun Gate intersection, which remained submerged during the heavy rains that hit the Seoul metropolitan area in 2010.

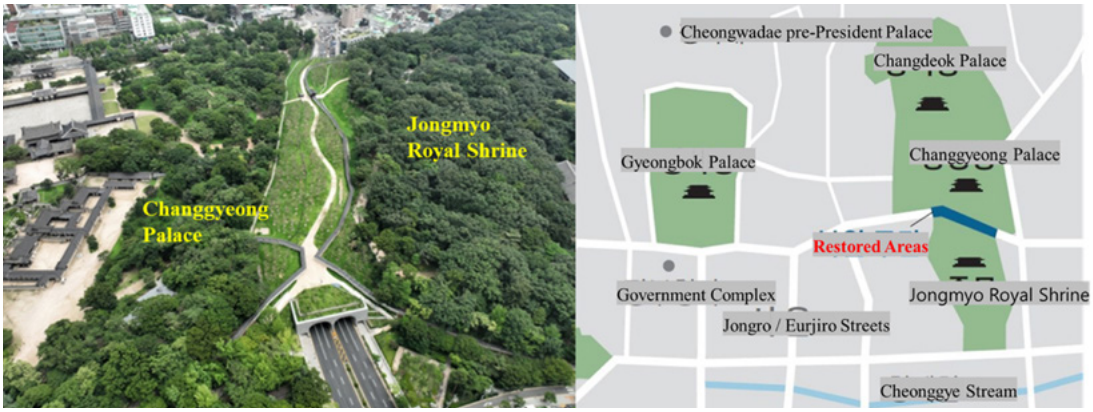
The spread of **green mobility** is possible within cultural heritage areas as well as through the restoration of green tissues. Recently, the Joseon Dynasty buffer zone between Jongmyo Shrine and Changdeokgung Palace was restored as a pedestrian-centered green forest path. Jongmyo Shrine and Changdeokgung Palace had been connected via a forest path during the Joseon Dynasty, yet this green axis was cut off when a crossroad was opened in 1934 during the Japanese colonial period in order to reduce time spent traveling eastward, destroying the sacred spirit of the nearby mountain range. This historically significant project has not only restored the green axis to the environment; it has also rejuvenated the traditional symbolism of the Joseon Dynasty, which was severely damaged by the Japanese occupation authorities.

The re-construction of the forest path of the royal tombs of the Joseon Dynasty transformed the area into a pedestrian-oriented structure, contributing significantly to carbon reduction. The road servicing emergency vehicles or those for the disabled allows only electric vehicles, while access by vehicles powered by fossil fuels is strictly controlled. A tunnel

under the heritage site maintains the existing road, which has been widened from four to six lanes and includes a new 690-meter stretch.

Thus, the project includes both climate-change mitigation as well as adaptation activities. The mitigation aspect refers to the creation of a new carbon-neutral space by connecting the disconnected green axis between Jongmyo and Changgyeong Palace. Yet, the tunnel is clearly part of Seoul's adaptation plans as it provides technology to support and maintain the green space above.

Figure 3.18 Restoring green axis between Changdeok Palace and Jongmyo Shrine with a pedestrian path, a carbon neutrality goal



Source: Original figure for this publication.

Photo 3.12 Adaptation approach: Changdeok Palace walls, reconstructed using more than 20% of the stones excavated during the restoration, and six-lane concrete tunnel for vehicular traffic

Source: Author.

Seoul's eco-friendly travel destination spots serve as buffer zones against climate change

An estimated 11% of global GHG emissions are attributable to tourism,[23] and this proportion is expected to double by 2050, which scientists have predicted to be a tipping-point year for multiple ecological catastrophes. For example, by then, the planet is predicted to be 1.5°C warmer than pre-industrial times—and by the end of the century, that figure is likely to be 2°C, and half a degree makes a big difference. If emissions a re left unchecked, this warming will only accelerate, leading to a distinctly higher level of catastrophic weather patterns.

Strengthening the role of buffer zones in preserving the surroundings of heritage sites can be an effective way to help counteract the impact that tourism activities have on the quantity of GHG discharge. Buffer zones around cultural heritage sites can be rehabilitated by mitigating (cultivating forest) and adapting (rainwater storage), as countermeasures against the primary sources of emissions linked to tourism: travel, food, and goods. Seoul's eight key eco-friendly travel destination spots can serve as buffer zones and as important countermeasures against climate change. They include Seoul Forest Park, Cheonggyecheon Stream, City Hall Green Wall, Pureun Arboretum, Seoullo 7017 Overpass (described earlier in this chapter), Jarakgil Trail (Ansan Mountain), Naksan Park and Olympic Park. Visitors to all eight sites see the beautiful landscape and the history (Joseon Period, 1392-1910), of the places, from the ancient to the present at a glance.

Seoul Forest Park is a buffer zone that protects the landscape of the Han River, which runs through Seoul, and cultural assets related to the waterworks. Established in 2005, it is a city centre green space modelled after New York's Central Park and London's Hyde Park. There are tunnels of large-scale drainpipes, each with a diameter of about 10 meters and located 40 to 50 meters underground. Cheonggyecheon Stream is a significant touristic zone that promotes an eco-friendly urban design and restores the history and culture of the east-west axis of Seoul. Due to neglect and development after an elevated highway was constructed in 1968, the stream had been left nearly dry; today, 120,000 tons of water are pumped in daily from the Han River, its tributaries, and from groundwater from subway stations.

Photo 3.13 Six of Seoul's eco-friendly travel destination spots

Source: Author.

City Hall's Green Wall is a vertical garden extending from the first to the seventh floors of an inside wall, measuring 1,516 square meters, transforming the building into a more environmentally-friendly space. Pureun Arboretum is an up-and-coming tourist attraction for international travellers. Originally an area of unauthorized buildings, shanty towns, and dense industrial zones, the arboretum is a part of the Blue Seoul initiative and aims to prevent urban sprawl and create an eco-friendly ecological space, enabling visitors to walk along a railroad track near the arboretum. At Ansan Jarak-gil, a 7km raised wooden deck trail encircles the entire circumference of the Ansan Mountain. It is the country's first barrier-free mountain and travel zone walking trail, with gentle slopes that allow visitors of all ages, young or old, to experience walking through the woods. Naksan Park is a major centre for tourism located at one of the four inner mountains surrounding Seoul. Some people called it Taraksan (Camel Milk) Mountain because a ranch run by the royal family was located there and the mountain's shape resembles that of the back of a camel. In the 1960's the Seoul Metropolitan Government carried out the Naksan Reconstruction Project, removing apartment buildings and low-cost housing, restoring the topography and shape of Naksan to provide a new buffer zone. Eventually, in 2002, the area was transformed into a park. Finally, Olympic Park is an impressive travel spot where historic remains from the Baekje era (1st century BCE to the 7th century CE) share space with modern, state-of-the-art sports stadiums, an eco-friendly forest, and spacious grass fields. As a legacy of the 1988 Seoul Olympics, the park not only houses the country's largest sports arena, but has also become a place where Seoul residents come to relax and unwind.

These many examples of climate-change mitigation and adaptation initiatives are also comfortable places for travelers. The buffer zones described in this section prove that cultural heritage and green spaces can coexist together, provided that they are utilized as tourism resources. Moreover, carbon emissions from visitors can be continuously reduced through the expansion of these environmentally friendly green areas.

Lessons learned from Seoul's climate-change mitigation and adaptation actions

This chapter has illuminated Seoul's many institutional, technical, socio-cultural and financial barriers to implementing climate-change plans and policies. These barriers may be similar in other developed and developing country contexts. The cases of conservation in Seoul mentioned so far show that using cultural heritage as a buffer zone can contribute to climate-change mitigation and adaptation. Compared to other regions, green buffer zones are continuously being produced in Seoul. However, their relative importance and the configuration of their interdependencies could be perceived differently in different countries. For example, recent findings indicate that the Seoul Metropolitan Government determined that financial barriers were perceived as less important, while in developing countries, financial barriers were perceived as the third most-salient barrier. Such contextualized understanding is critical to upscale and outscale findings.[24]

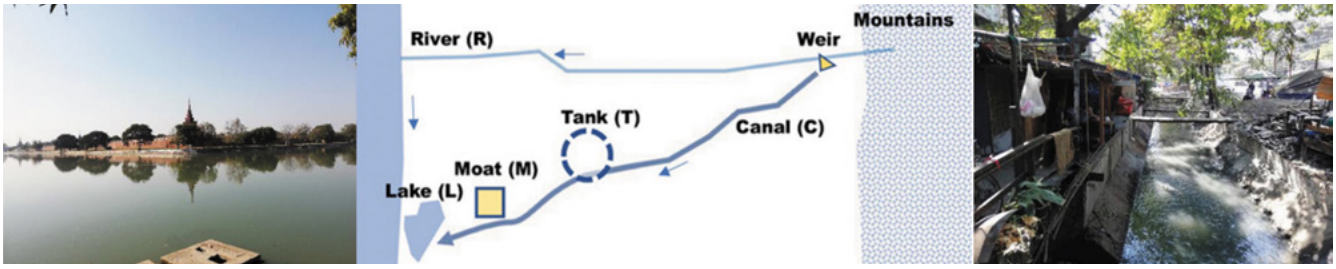
Due to these accumulating concerns, and despite the good practices noted in this study, Seoul's climate-crisis actions have a fatal problem. There is a recognition of the urgency of climate change, but also a lack of climate-change adaptation policy, climate risk and vulnerability assessments, and knowledge of which cultural heritage to retain and change. These factors appear to be intertwined Most importantly—and the most frequently cited barrier by experts—there are no basic analogue damage indicators for how climate change affects heritage sites. For instance, insufficient knowledge about climate risks and vulnerability and limited knowledge about which heritage types to preserve and adapt or transform can hinder climate-change adaptation policy for cultural heritage. Similarly, limited funding, weak public support, competing and conflicting priorities among sectors, and poor awareness of heritage benefits for a wide range of sectors can constrain climate-change adaptation policy.

Moreover, ignorance of these interdependent constraints leads to wasted efforts. Seoul still focuses on development without regard to the protection or conservation of vulnerable buildings and cultural heritage within the old city center (formerly Hanyang Province). An additional flaw in Seoul's efforts is lack of cooperation, which can exacerbate technical barriers, in particular the lack of knowledge about appropriate cultural heritage to retain and change, lack of integrated management of cultural heritage and biodiversity, lack of integrated intangible and tangible heritage management, and lack of knowledge about the impact of energy transition on cultural heritage. Lack of cooperation impacts institutional barriers as well, such as lack of sharing best practices and lack of awareness of cultural heritage benefits.

Replicability of tested climate actions in Seoul, particularly for developing countries

The issues mentioned in the previous section are those that Seoul must continue to address. In doing so, the city can serve as an important role model for developing countries. The application of similar climate crisis mitigation-adaptation actions via the five strategic models and involving cultural heritage can make a significant contribution to overcoming the climate crisis while sustainably preserving and managing heritage zones. In terms of financial cost, compared to adaptive techniques, mitigation methods have proven to produce meaningful results at relatively low cost. In that respect, climate-change adaptation policies are likely to be the most effective and feasible approach for developing countries. In addition, green technologies using extensive heritage sites as a mitigation tool are also effective models as they can help alleviate the climate crisis caused by rise in sea levels, increase in the number of days of intense rainfall, and increase in the frequency of drought due to high temperatures. They may also be the most accessible ways for developing countries to achieve climate goals. Transfer of technologies to mitigate climate change, including under the support of the CHA, through an ODA project with underdeveloped countries could be of great help in realizing carbon neutrality worldwide.

Figure 3.19 Mandalay's schematic of a hydraulic system



Source: Yamada, 2023.

There are three ways eco-friendly tourism spots at Seoul's cultural heritage sites are conserved and that could be followed in developing countries: 1) preserving ecosystems that are intertwined with daily life for local communities, 2) enhancing access to heritage as a buffer zone, and 3) building adaptation and mitigation facilities in response to climate change. All are designed to strengthen buffer zones and serve as countermeasures against climate change.

One example in South-East Asia might be the creation of an effective buffer zone to rehabilitate ecotourism along the hydraulic system that runs through the ancient cities of Cambodia, Myanmar, and Laos by installing climate-change adaptation technologies along the living ecosystems and ancient sites that have formed around them (a hydraulic system is defined as the configuration of elements comprising natural and artificial facilities for the

intake, transfer, storage, supply, and discharge of water). The hydraulic network for the city of Mandalay, in Myanmar, is a roughly rectangular area bounded on the west by the Irrawaddy River, on the south by the Mytinge River, on the east by the mountain ranges of the Shan Highlands, and on the north by the Chaung Ma Gyi River. To enable gravitational flow, elevated canal intake points were established at the foot of the mountains to the east of Mandalay. Canals in the area follow the natural slope of the terrain, generally from east to west and north to south, and have long been part of the area's hydraulic system, which is comprised of the man-made elements of weir, canal, and tank, as well as the natural elements of river and lake. They were built in the twelfth century to provide a stable water supply for farmland irrigation and increased crop production. Later, the purpose of the hydraulic system shifted from irrigation to supplying water to the palace and the city, and any surplus water was used for irrigation.[25] To strengthen buffer zones and their functions, as seen in Seoul's case, the restoration of such systems would stabilize the existing axis formed around cultural and natural heritage with green buffer zones such as roads, rivers, mountain ranges, etc. that preserve the traditional axis. In Mandalay's case, restoration of the traditional topographic axis and system has been important for maintaining a stable waterway for increasing crop production and supplying water between Mandalay's outer cities and the central zone, as well as serving as a countermeasure against climate change.

As this chapter has asserted, cultural and natural heritage places can act as buffer zones to slow climate change, and urban areas damaged by climate change can foster natural resilience through the proliferation of cultural heritage zones. The detailed analysis of cases that follow the five adaptation and mitigation strategy models discussed in this chapter support the contention that cultural heritage can be used as a tool to mitigate climate change and address the climate crisis.

Hwaseoung Fortress, Suwon – KRIHS

CHAPTER 4

Suwon Case Study

Suwon's Experience in Cities, Culture and Climate Change

Dohyung Kim, Researcher

GYEONGGI CULTURAL FOUNDATION

Introduction

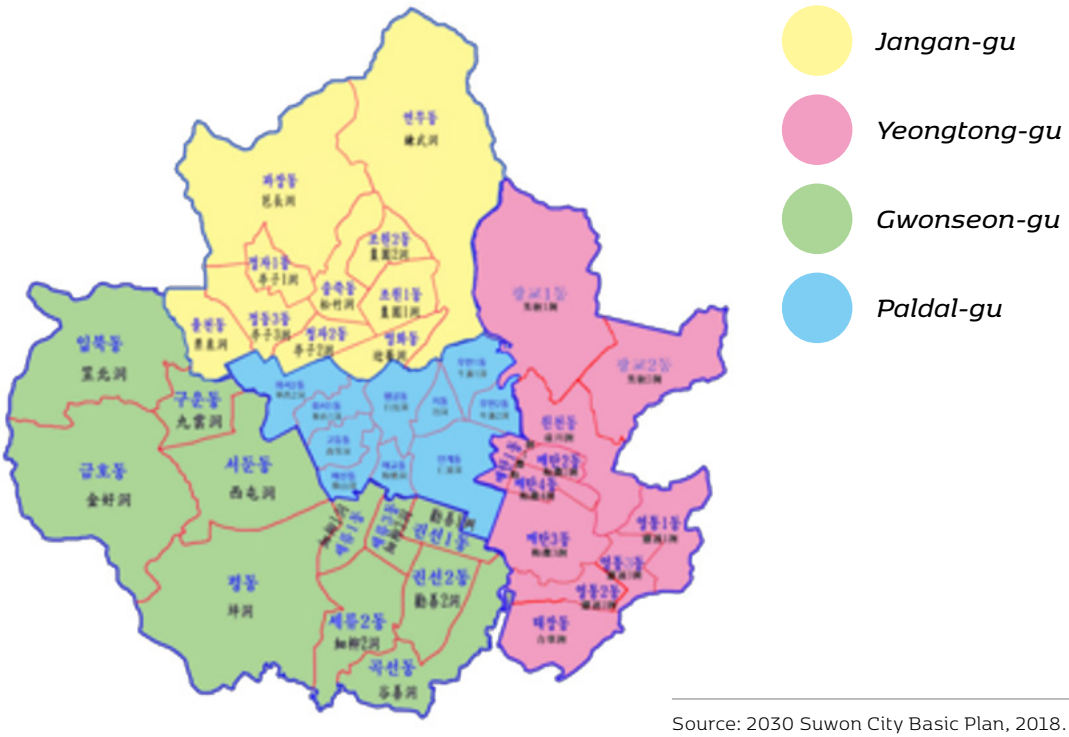
Korea's Suwon City has been at the center of the country's urban development since the Middle Ages. This chapter aims to shed light on cases in Suwon City of relatively harmonious coexistence between urban development and culture heritage from the perspective of climate-change adaptation and mitigation—in particular, the role of the local community and its emergence as a major stakeholder in various fields related to cultural heritage development and promotion. One representative case is that of Hwaseong Fortress, a UNESCO World Heritage site in Suwon City, which has led to the increase in tangible and intangible values of Suwon City and is characterized by voluntary cooperation of local communities and public-private cooperation partnerships.

Case study description and rationale

The story of Suwon City centers on the history of the expansion of Seoul, Korea's capital, and the subsequent growth then decline of Suwon City. The decline of Suwon's original city center, the damage to the city's intrinsic value due to the development of sub-centers, and, especially, the overall decline in economic growth due to COVID-19, have created a substantial crisis—the collapse of the local community's foundation for self-reliance. In addition, the city's response to the effects of climate change, through efforts at carbon neutrality or carbon reduction, is recognized as a risk and cost to many segments of the community, including local governments.

The chapter examines how Suwon City has overcome these complex and multi-layered crises and begun to restore the essential values of Suwon City by establishing and proceeding with sustainable public-private partnerships and engaging the local community to support and promote cultural heritage as a means to address the climate crisis.

Figure 4.1 Suwon City administrative districts



Source: 2030 Suwon City Basic Plan, 2018.

Suwon City is located in the southwestern part of Korea's Gyeonggi Province and is the seat of the Gyeonggi Provincial Government Office. It borders Yongin City to the east, Ansan City to the west, Hwaseong City to the south, and Uiwang City to the north. Its city hall is located in Ingye-dong, Paldal-gu, and there are four general districts: Jangan-gu, Gwonseon-gu, Paldal-gu, and Yeongtong-gu (Figure 4.1). On January 13, 2022, Suwon City officially became a "special city", along with Changwon, Yongin, and Goyang. This designation is awarded to cities with over 1 million inhabitants and allows them a degree of autonomy from the national government when it comes to certain rules and regulations. It has the largest population among the local metropolitan government bureaus in Korea. Suwon City is home to the Hwaseong Fortress, a UNESCO World Heritage Site, as well as Samsung Electronics' R&D center and its headquarters, which are located in Maetan-dong, Yeongtong-gu. District. It is also an educational center and includes 11 universities.

Since the 2000s, the government has taken advantage of efficient development and low-cost supply of land to construct 1 million national rental housing units, alleviating the housing shortage, contributing to the stabilization of residential life, improving the welfare for the common people, and promoting balanced development and healthy natural environment in Suwon. These units have been developed in the West Suwon area through the following district-based development projects:

- Homaesil housing site in the Homaesil area of Gwonseon-gu to promote environmentally friendly urban development.
- Suwon General Industrial Complex, for the revitalization of the West Suwon area (stage 1, February 2003; stage 2, May 2005; stage 3, October 2013).
- Iui-dong, Yeongtong-gu, Sanghyeon-dong, Suji-gu, and Yongin-si, a multi-functional and self-sufficient administrative city that encompasses a wide area, with high-tech industrial locations and a new residential complex plan designed to alleviate the housing shortage in the metropolitan area while contributing to the stabilization of people's residential life and improved welfare.
- Gwanggyo housing site (move-in began in 2011).[1,2]

Economic characteristics

Suwon City's expansion since 1990 has served as an opportunity to achieve balanced development through the attraction of large corporations, including Samsung Electronics and SKC, and the development of Gwonseon, Yeongtong, and West Suwon areas.

As a result of this development, the city's overall total population has increased continuously from 1994 to 2017. However, within Suwon, population growth has been uneven: populations of Yeongtong-gu, Gwonseon-gu, and Jangan-gu have steadily increased, while Paldal-gu has been in continuous decline since its subdivision with Yeongtong-gu in 2003.

The number of businesses in Suwon has continuously increased, from 46,251 in 1997 to 68,332 in 2015, a 147% increase (Table 4.1).

Table 4.1 Change in number of Suwon City businesses, by district

Divison	Total (Suwon)	Jangan-gu	Kwonseon-gu	Paldad-gu	Yeongtong-gu
1997	**46,251**	13,946	16125	10,635	5,545
2000	**51,711**	15,250	17,549	10,734	8,178
2003	**56,810**	13,354	14,582	18,211	10,663
2006	**55,854**	13,166	14,867	16,858	10,963
2009	**56,453**	13,325	15,731	16,013	11,384
2012	**63,865**	14,284	18,318	18,183	13,080
2015	**68,332**	14,360	19,375	18,808	15,789

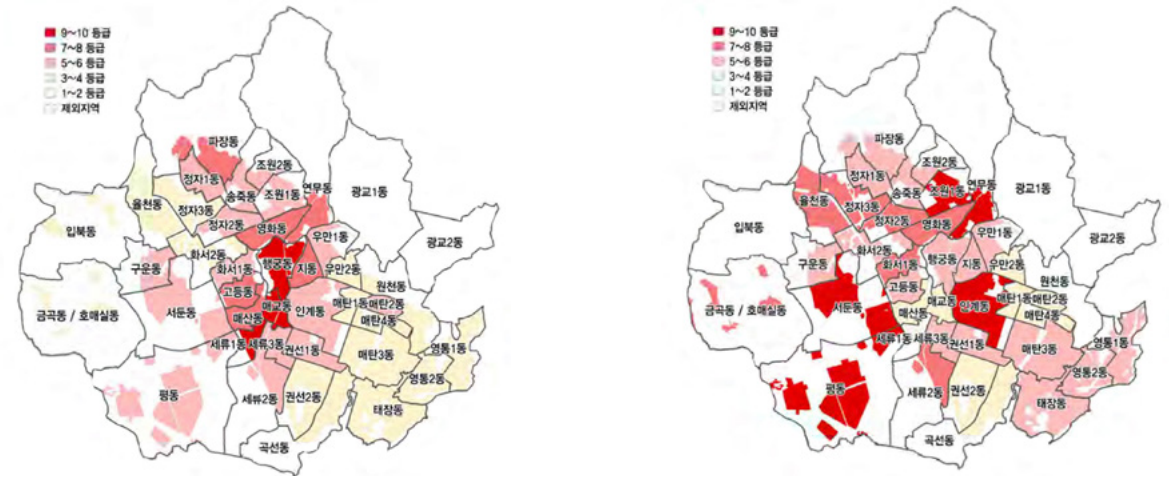
Source : https://www.suwon.go.kr/stat/index.do.

Social features

Suwon City's balancing development is being carried out for the purpose of creating large-scale residential complexes as well as industrial complexes in surrounding areas, excluding the original downtown area. That development has resulted in an unbalanced urban structure and the emergence of slums.

For example, the Haenggung-dong district, the old city center, includes Suwon Hwaseong, a World Heritage Site that embodies the historical identity of Suwon.

Figure 4.2 Suwon City's historic Haenggung-dong district: low economic activity and high elderly population



Economically active population | *Number of elderly people*

Source: Suwon City Urban Regeneration Strategic Plan, 2021.

This district and its northern regions (Yeonmu-dong, Yeonghwa-dong, Jowon-dong, etc.) are in former downtown areas and show relatively high declines on various demographic and social indicators (Figure 4.2). The western areas of Haenggung-dong, such as Seodun-dong and Pyeong-dong, are home to many natural and conservation green areas. Here, residential and urbanized pockets are scattered throughout these districts and the elderly population is the highest compared to other areas.

Role of local communities

With the creation of a new city center and the decline of the old one, the role and scope of the local community has become extremely limited, underscoring an aspect of confrontation rather than mutual cooperation. In particular, Suwon's original downtown community is now saddled with the seemingly incompatible responsibility of protecting heritage areas and exercising property rights, and unconditionally opposes the support and cooperation of local governments from other Suwon City districts.[3]

Major challenges and threats to climate-change action in Suwon City

The most significant impediment to Suwon City's efforts at establishing a sustainable model between urban development and culture heritage through climate-change adaptation and mitigation is the lack of integrated policies. The government's urban development approach is really a redevelopment policy that breaks down aging buildings in declining areas and constructs modern buildings—of a uniform design—in their place. Despite the lack of an independent corrective plan, climate change remains a low priority for both urban and environmental planning.

Recently, the 2030 Suwon City Urban Development Plan was changed from the Suwon Urban Development Plan (2018, 2020-2030) to the more technology-inclusive Suwon Smart City Plan (2021-2025), enacted in 2020. Furthermore, the city's comprehensive climate-change response plan is in the process of being modified from the Suwon Climate Change Adaptation Plan (2014-2018) and linked with the Suwon Smart City Plan. These policies are described in more detail in the following sections.

The 2030 Suwon City Urban Development Plan, enacted in 2020, focused on the overall balancing of development of the city.

Table 4.2 2030 Suwon City Urban Development Plan, 2020, areas of focus

Focus area	Activity
Basic survey & status analysis	– Urban characteristics and current status
Urban basics foundation	– Setting goals and indicators of the plan - Establishment of future urbanization planning, population indicators – Planning zones for residential, commerce, as well as green spaces between areas under development - Development axis, green axis, transportation axis, living zone setting and population allocation
Departmental plans	– Land-use plan – Landscape and aesthetic plan – Infrastructure plan – Park green plan – Urban and residential environment plan – Disaster prevention and safety – Environmental conservation and management plan – Economic, industrial, social, and cultural development and promotion
Plan realization	– Fiscal expansion, financing, and implementation strategies

Source: 2030 Suwon City Urban Development Plan, 2020.

However, the Suwon Smart City Plan, in effect since 2020, aims to maximize efficiency by incorporating various modern, "smart" technologies into the foundation of a developed city.

Table 4.3 Suwon Smart City Plan, 2020, areas of focus

Focus area	Activity
Suwon City environmental and characteristic-based smart tech services	– Balanced development of urban areas, etc. – Providing state-of-the-art technology-based services through demand forecasting
Various city promotional campaigns (including safety management)	– Establishment of integrated smart city foundation in connection with geographic information system and intelligent transportation system – Informatization of urban management systems such as transportation, methods, energy, environment, and disaster prevention
Consideration of urban characteristics, creation of business model	– Existing and new development districts, industrial complexes, Suwon Hwaseong, etc. – Creating an urban brand considering safety and environment
Business continuity through "smart" city planning	– Balanced development of old and new towns with aging infrastructure Intelligent public facilities planning Review of the Integrated Urban Operation Center
Public-private partnership business promotion	– Development of urban services for public-private cooperation – Combination of private capital and technology

Source: Suwon Smart City Plan, 2020.

The Suwon Climate-Change Adaptation Plan, 2014-2018, recognizes the urgency of climate change and its impacts on citizens' daily lives, but from the perspective of disaster prevention.

Table 4.4 Suwon Climate-Change Adaptation Plan, 2014-2018, areas of focus

Focus area	Activity
Climate-friendly construction of urban infrastructure	– Introduction of urban management measures for climate-change adaptation – Improving urban infrastructure and strengthening resilience to reduce disaster damage – Securing water resources and managing water quality against abnormal weather conditions – Mitigating urban heat islands and enhancing water circulation function
Improvement of health and welfare for the climate-vulnerable class	– Integrated monitoring of climate change and health Improving the health and quality of life of the vulnerable in the – climate environment
Promoting health and resilience in an urban ecosystem	– Enhancing urban agriculture – Strengthening the buffering function of climate change with river and mountain belts – Ecosystem and green area management against extreme climate
Creating citizens with environmental capital Cultivating adaptability Improving sustainability	– Enhancing climate-change adaptation partnerships – Securing global leadership on climate change – Promoting citizenship and establishing a foundation for adaptation

Source: Suwon Climate-Change Adaptation Plan, 2014-2018.

The Suwon City Climate-Change Response Comprehensive Plan, enacted in 2020, expands the scope of the Suwon Climate-Change Adaptation Plan, setting detailed goals for each sector that ae centered on infrastructure approaches such as energy conversion and resource circulation.

Table 4.5 Suwon City Climate Change Response Comprehensive Plan, 2020, areas of focus

Focus area	Activity
Energy conversion, i.e. expanding new and renewable energy	– Expansion of renewable energy - Detailed objectives for each sector (transport, building, waste)
Eco-friendly transportation (pollution-free vehicles, green transportation)	– Establishment of AI-based smart transportation system – Expansion of shared mobility such as shared bicycles
Zero-energy city (zero-energy building, green remodeling)	– Improving building energy (LED, air conditioning, heating) efficiency – Green remodeling – Expansion of new and renewable energy supply
Resource circulation (recycling of discarded materials, bioplastics)	– Use of biogas and introduction of bioplastics – Introduction of smart collection system for waste materials – Review of the Integrated Urban Operation Center
Civil life (building consensus and expanding participation)	– Expanding civic education and participation opportunities – Induce policy-based participation to realize carbon neutrality

Source: Suwon City Climate Change Response Comprehensive Plan, 2020.

As discussed, Suwon City's urban development-climate change-culture (heritage) policy is being promoted independently, without a cohesive, overarching plan, according to the situation and conditions of the relevant department, so there is no synergy effect through mutual cooperation.

As mentioned above, Suwon City has long played a role as a military, logistics and commercial center supporting Seoul. Its Suwon Hwaseong Fortress has been loved for generations—especially since it was listed as a World Heritage Site in 1997—and is located in the middle of the original city center. Thus, the issues of balancing growth and development, preservation of the original city center, and the need for climate-change measures and policies are directly related to the very identity of the city.

Strategies and actions for climate-change mitigation and adaptation in Suwon

Suwon is characterized by advocacy for the city's historical and cultural assets, existing segmented urban development, and cultural heritage policies develop in a mutually cooperative manner. These policies include those of urban regeneration based on regional characteristics and involve voluntary participation of local communities. Climate-change issues are at the center of these mutually cooperative intersections.

Suwon's Special Act on Urban Regeneration and Support (abbreviated as the Urban Regeneration Act) promotes urban regeneration by strengthening local capabilities, introducing and creating new functions—such as an urban regeneration focus that balances land and local resources—and utilizing local resources.

Voluntary participation of the local community has been critical to the promotion of the Urban Regeneration Act and the local government

promulgated the Suwon City Village Creation Ordinance in 2010 to help. In terms of implementation of the ordinance, an infrastructure construction project and the implementation project for revitalization are being carried out simultaneously. The foundation construction project involves the Suwon Village Creation Support Center, where the Village Creation Promotion Group offers studio-type education—an educational approach that involves open discussion and which is considered more beneficial than lectures at solving village problems.[4]

Against this backdrop, urban development (restoration), culture (heritage), and climate change policies intersect in specific projects described in the following sections.[5]

Table 4.6 Comprehensive Environmental Conservation Plan, 2016, areas of focus

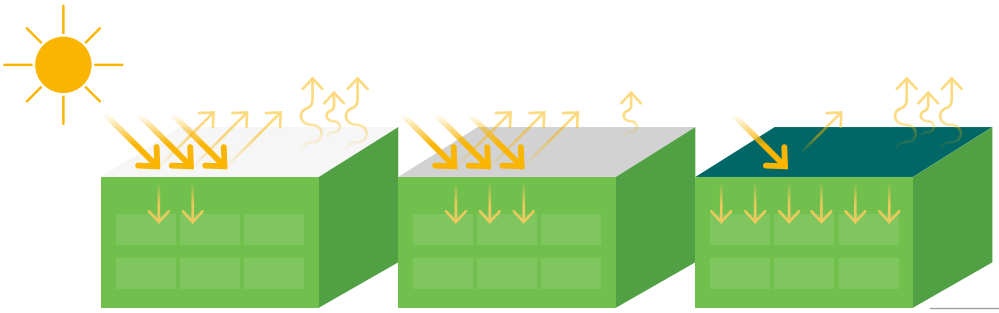
Focus area	Activity
Urban development, urban restoration	Regeneration of Suwon's original city center / re-creation of urban value/ low-carbon green city – Establishment of an environmentally friendly land-use plan – Sunlight Power Plant – Energy-saving demonstration village, demonstration apartment – Nanum Sunlight Power Plant
Climate change	Strengthening climate resilience / carbon neutrality / ecosystem recovery – Rooftop greening / wall greening – Expansion of renewable energy – Creation of urban heat island maps and cool cities – Establishment of guidelines for adapting to climate change in Hwaseong

Source: Comprehensive Environmental Conservation Plan in Suwon City, 2016.

Promotion of cool roof project[6]

A building's roof color is related to its ability to reflect the sun's visible rays, infrared rays, and ultraviolet rays, and reduce the heat gain of the building or increase its cooling efficiency (Figure 4.3). The darker the color, the more solar heat that is absorbed during the day is transferred to the inside of the building, increasing the cooling load, which is especially important in summer months. In the United States, installation of cool roofs is actively encouraged, and cool roofs are designated as one of the 10 technology fields actively promoted by the Small and Medium Business Innovation Research Program supported by the U.S. Department of Energy (DOE).[7]

Figure 4.3 Effect of solar heat on roofing styles



Source: Comprehensive Environmental Conservation Plan in Suwon City, 2016.

In Korea, national government departments—including the Ministry of Trade, Industry and Energy and Korea Energy Management Corporation—as well as various local governments are beginning to recognize the need for more buildings to introduce a white roof or cool roof to reduce energy consumption.[8] And as experts at various energy-related conferences or climate-change forums echo the importance of white or cool roofs, Suwon City is now expanding its cool roof policy, budgeting KRW500 million every year since 2016 to installing cool roofs on houses, schools, and public buildings in the vicinity of City Hall.

Expected effects of Suwon City's cool roof initiative:

- Building energy reduction and greenhouse gas reduction
- Acquisition of economic feasibility through energy reduction in the building sector

Energy conservation demonstration village[9]

Figure 4.4 Promotional vehicle of Energy Opportunity Income Village, 2023

Source: Gyeonggi Provincial office, 2023.

The Energy Opportunity Income Village Creation Project supports 80% of the cost of installing public solar power plants in villages, especially in rural areas with low energy use due to low incomes, effectively providing rural residents energy free of cost. Every village or community that participates in the project is awarded with so-called opportunity income, or power-generation income. When applying last year's average sales revenue and power\price (SMP) of each Renewable Energy Supply Certificate (REC), KRW150,000-KRW160,000 per month per household will be awarded as opportunity income, excluding the costs of renting and managing the plant for 20 years—the average life of a solar power plant. Each solar-power facility generates 10-15kw per household and makes a profit of KRW3.66 million per year out of KRW18.3 million in initial installation costs.

Expected effects of Suwon City's Energy Opportunity Income Village Creation Project:

- Household energy reduction and greenhouse gas reduction
- Acquisition of economic feasibility through energy reduction in the village sector

Establishment of a low-carbon, non-power-oriented bike-sharing system[10]

Photo 4.1 Bike-sharing system

Source: chosun.com.

In response to climate change and global warming and in an effort to foster a low-carbon, green-growth society, Suwon City introduced a ubiquitous (available anytime, anywhere) and multi-faceted public bicycle system as the most effective prescriptive alternative to environmental pollution, excessive energy use, and traffic congestion caused by a significant increase in automobiles. Social and economic effectiveness of the program has been proven through widespread public support for the introduction of the public rental bicycle system, establishment of the bike-sharing system, and establishment of a bicycle-public transportation linkage system.

In addition, the bicycle system is expected to lay the foundation for the further spread of bicycle culture, by utilizing bicycle city associations, operating bicycle city federations, linking private organizations such as bicycle donation campaigns, and building a cooperative bicycle system between cities.

Expected effects of Suwon City's public bicycle system:

- Achieving green growth by fostering a domestic bicycle business
- Realizing GHG reduction, through bicycle use, of three tons of CO_2eq/thousand units per year to address environmental pollution, excessive energy use, and increased traffic congestion
- Improving citizens' health and well-being

Mini solar power installation support project[11]

Existing residential solar-power installation support projects mainly target detached houses, while solar installation for individual apartment residents has long been more challenging. In response, Suwon City implemented a project to supply solar-power generators to 97 households, and by 2015, 100 households per year were being supplied with solar-power generators.

Figure 4.5 Promotional vehicle for mini solar power generator installation, 2022

Source: https://news.suwon.go.kr/?p=26&viewMode=view&reqIdx=202306020923440560.

Residential solar power generation capacity is small compared to that of larger facilities, yet solar power is a clean and unlimited eco-friendly energy source. A tariff system can significantly reduce electricity bills, and the savings effect is greater for households with higher electricity consumption.

If the solar panel is affixed to the outside of the residence, such as on the veranda, and the plug attached to the inverter is inserted into an outlet inside the home, 250w of power per year can be produced. This is the amount that a typical air conditioner requires to operate for one hour per day per month.

Cultural heritage programs with input from the local community

Suwon City operates and promotes two distinctive cultural heritage programs with significant participation, support, and input from the local community.

King Jeongjo's Royal Tomb Parade

The initial King Jeongjo's Royal Tomb Parade was a large-scale procession held by the 22nd king of Joseon, Jeongjo (1752-1800, reigned 1776-1800), in the year of Eulmyo (1795) to commemorate the 60th birthday of his mother, Hyegyeonggung Lady Hong.

From February 9-16, 1795, the 20th year of his accession, King Jeongjo moved the tomb of his biological father, Jangjo (Crown Prince Sado), from Mt. Among in a large-scale procession, the Eulmyo Year Hwaseong March. About 6,000 people and 788 horses were mobilized for this royal procession,

which commenced at Donhwamun, the main gate of Changdeokgung Palace at the time. Details of the procession were recorded in the Wonhaengeul Myojeongri Uigwe, which consists of eight volumes detailing the official schedule of the royal tomb procession, along with an explanation of the palanquins and equipment.

Since 1996, Suwon City has been holding an annual event to recreate King Jeongjo's Royal Tomb parade around Suwon. In 2016, the 200th anniversary of the construction of Suwon Hwaseong Fortress, Suwon, together with the Seoul Metropolitan Government jointly recreated the 47.6km section of King Jeongjo's royal tomb parade, linking Changdeokgung Palace in Seoul to Yeonmudae of Suwon Hwaseong Fortress for the first time. In 2017, the city of Hwaseong-si, in Gyeonggi-do province, also participated in the re-enactment, and the three cities staged a reproduction of the 59.2km section that extended from Changdeokgung Palace to Yungneung, the tomb of Crown Prince Sado.

Although the parade has been temporarily suspended due to COVID-19, pre-pandemic data from 2018 indicates the total number of tourists who participated in reenacting the King Jeongjo Royal Tomb Parade for two days on October 6-7, 2018 was 67,943, 99 % (67,267 people) of whom were domestic tourists.

Suwon Hwaseong Fortress Media Art Show

This media art show illustrates King Jeongjo's dream of Suwon Hwaseong as a "new city of reform," by bathing the façade of Hwaseong Fortress in modern colorful light. King Jeongjo dreamt of and planned the city as a utopian ideal with extreme filial piety and deep love for the people, and this dream is said to be connected to the flow of time. The show, "Dream of reform - Road of reform - Construction of a new city – Despair, people's happiness", directed by the Suwon Cultural Foundation. In 2021 the art show was concentrated at the Hwaseomun gate of the fortress, while this year's show extended from Hwahongmun to Namsumun and Suwoncheon.

The Suwon Hwaseong Media Art Show is characterized by a high participation rate and is designed to evoke historical liveliness in the audience by projecting, through media façade techniques, the heritage of King Jeongjo the Great through to contemporary Korean history.

Participation of various local communities in other medica art shows is expanding. These exhibitions include laser tunnels, art landscape lighting, infinity rooms, community-based artist contests, and work exhibitions consisting of holograms, interactive exhibits, and other lighting art.

Characteristics of Suwon's public-private partnership program

The two programs described in the previous sections are both based on the unique values of the local community and made through voluntary cooperation and participation with the local community.

As noted earlier in this chapter, Suwon City suffered damage to its essential cultural value due to rapid urban development, and the government has made efforts to heal conflicts with the local community in the process of downtown redevelopment. In order to secure the sustainability of Suwon City, it remains essential to establish a voluntary cooperation system among various stakeholders, with the local community as the focal point.

Both the Royal Tomb Parade and Media Art Show are not only seeing increases in the number of participants; they are increasing in appeal to local participants across generations.

Intangible cultural heritage value of King Jeongjo's Royal Tomb Parade

The original King Jeongjo's Royal Tomb Parade was less a ceremonial event and more entertainment and a show of military strength. It was also a way for the king and the public to interact. People could enjoy the spectacle of observing the king's conduct and had an opportunity to voice their opinion about their sovereign. In other words, from the king's point of

view, the parade was a means to both display power and give back to his people; from the public's point of view, the parade came to signify a chance to play and communicate with their king.

Creation of digital archive and copyright registration

The historical record of King Jeongjo's Royal Tomb Parade has been meticulously preserved, including documentation on the changing aspects of the event, and sufficient conditions have been met to build meaningful and searchable metadata. The next step is to prepare for the possibility of damage and deterioration of intangible cultural heritage related to the Royal Tomb of King Jeongjo and to develop various types of digital content to generate user interest and engagement.

Development and commercialization of festival identity

There is a need to develop a festival identity (FI) for the King Jeongjo Royal Tomb Parade in order to form a cohesive brand and imaging strategy across participating local communities and governments to enhance commercialization. The establishment of an integrated branding strategy that supports a profitable business linked to FI may reduce the dependence of local governments on the festival budget and improve the quality of festival content planning and operation.

The success of the Suwon Hwaseong Fortress Media Art Show comes from how today's visitors have ascribed value to the cultural heritage of King Jeongjo and from the utilization of technology. This has led to a recognition of the importance of voluntary participation through the spread of values and the formation of a consensus among generations as to the importance of Hwaseong as a culturally significant landmark.

Lessons learned from tested climate actions in Suwon City

As described earlier in this chapter, the development of Suwon City has been driven largely by external factors, such as the rapid growth and expansion of Seoul, rather than for internal reasons. Suwon City has achieved rapid growth through short-term, performance-oriented expansion rather than steady and balanced growth based on the city's intrinsic cultural value. Complex problems such as conflicts between administrative agencies and the COVID-19 pandemic exacerbated the impact of rapid development. In addition to negatively impacting the overall health and well-being of the county, the pandemic also promoted the spread of non-face-to-face culture centered online.

Among these complex crises, the issues of climate change and carbon neutrality, formerly recognized simply as costs, together became an opportunity to change social awareness around the explosive use of packaging containers that took place during the pandemic. At the same time, a consensus emerged that a multi-layered approach based on public-private partnerships of various stakeholders, including the local community, would be needed to solve such complex issues. The emergence of citizen planning groups can be seen as a representative example of this type of consensus-based approach. Various types of local community-based organizations working together with professional organizations, such as social enterprises and cooperatives, can lead locally-focused projects applied to diverse situations. The formation of organic networks between institutions and civic organizations, capacity-building programs for this purpose, and establishment of an administrative support system became the basis for these types of organizations.

The following are the key aspects to successful climate actions in Suwon City:

- Community participatory action
- Ongoing cooperation and collaboration

2022 Suwon Theater Festival climate-change event

One example of a local community-driven cultural event with a climate-change focus was the 2022 Suwon Theater Festival's Party in the Forest, which was held from May 20-22, 2022, mobilizing 190,000 spectators, and was widely considered a great success.

Visitors at the 2022 version of the annual festival joined together to reduce the use of about 10,000 disposable items over three days. Additional events included a recycling experience program in cooperation with Gyeonggi-do Up-cycle Plaza, which encouraged participants to practice resource recycling. In addition, the food area was an eco-friendly zone, designed to reduce large-scale garbage generated at the festival and minimize the use of disposable products. Food was available only in multi-use containers.

As a result, the festival could serve as a model for operating sustainable, eco-friendly carbon-reduction festivals, as illustrated in the data presented in Table 4.7.

Carbon reduction throughout the festival amounted to 897.44kg CO_2e, equivalent to the annual carbon dioxide absorption of 152.11 30-year-old cypress trees.

Table 4.7a 2022 Suwon Theater Festival climate-change response performance, use of eco-friendly containers

Container type	Amount used	Comparison group (same quantity)	Carbon reduction (kg CO_2e)
Reusable cup (58g/PP)	4,300	Disposable cup	129.347
Multi-use container (58g/PP)*	4,900	Disposable bowl	121.811
Paper pack bottled water (500L/Tetra Pack)	1,300	PET bottled water	31.330
Total			282,488

*Multi-use cups/containers are expected to be reused at least 10 times.

Table 4.7b 2022 Suwon Theater Festival climate-change response performance, waste reduction

Waste type	Reduction compared to 2019 (with no climate focus)	Carbon reduction (kg CO_2e)
Volume-based garbage (based on 100L/7.5kg)	7,500 litres	109.35
Food waste (based on 100lL8kg)	4,000 litres	505.60
Total		614.95

Source: Suwon Cultural Foundation (https://www.swcf.or.kr/).

Replicability of tested climate actions in Suwon, particularly for developing countries

Urban development efforts in Suwon involved both restoration of the city's identity and balanced development, and these twin processes were made through public-private partnerships that involved local communities. In particular, the voluntary participation of local communities and cooperation among administrative agencies—in capacity-building and institutional support—continue to provide the basis for active response to climate change, which is now considered an essential issue from a sustainability perspective.

Proposed King Jayavarman VII (Cambodia) Royal Parade, significance at the local level

As discussed in earlier sections, the annual reenactment of the King Jeongjo Royal Tomb Parade is carried out independently by nearby local governments, including that of Suwon. It embodies the idea of a completely public good and has intrinsic cultural value—social integration generations through cultural heritage. Developing countries that may have only limited resources and infrastructure can take this example to create a similarly significant event that is innovative, appeals to people across generations, and based on a shared cultural history. Equally important, applying the model of Suwon City's King Jeongjo Royal Tomb Parade can help build a foundation for local community independence.

One suggestion would be a similar annual event, a royal parade to honor the legacy of Cambodia's King Jayavarman VII, which could take place at Angkor, a UNESCO World Heritage site situated on the ancient royal seat of the powerful Angkor empire and located near the modern city of Siem Reap. Similar to Suwon's King Jeongio parade, the proposed King Javavarman Royal Parade would take advantage of Cambodia's history of cooperation among local community groups. However, for the parade to operate smoothly and continue to attract visitors year after year, specific roles and responsibilities for every single stakeholder must be identified:

Local communities: Develop and research their local histories, and share findings with local partners, including local governments. Teaching and training younger generations about cultural heritage is also critical for sustaining interest.

Local governments: Set the parade's major agenda and align with current global agenda related to climate change, carbon neutrality, and sustainability. Develop a support system for the local community, not just financial, and help with administrative tasks. Establish and share official criteria through which to assess event outcomes.

Visitors: Join parade as casual participants after having received necessary vocational training from authorized personnel and a certification of participation issued by the local government.

A King Jayavarman VII Royal Parade can give the local community across generations a historically significant cultural experience of the royal empire. At the same time, organizers could also incorporate sustainability issues into the event in an effort to encourage short-term visitors to stay longer, further embed themselves into the local community, and perhaps become a permanent member of the local community.

For its part, Suwon City's King Jeongjo's Royal Tomb Parade has proved the economic effectiveness of revitalizing the local community by attracting more than 300,000 visitors each year through a cultural-heritage program based on the historical value of Suwon City and with the voluntary participation of cast members from the local community. This can be replicated by developing countries with relatively limited capital and technology. Much as in Suwon City, cultural heritage events can be a way for developing countries to actively respond to climate change. Sustainability practices can also be encouraged—and goals achieved—through the participation and understanding of the local community. This is discussed in more detail in the following section.

Table 4.8 Proposed King Jayavarman VII Royal Parade at Cambodia's Angkor, a World Heritage site with UNESCO 5C analysis

Level	5Cs Criteria	Role & Responsibility	Climate Change Aspect	Carbon Reduction Aspect
Community	Credibility	– Literature survey reasearch – Discover community-based stories	– Do not need any physical structure – Typifocation of intangible elements	– Carbon Emission Neutral – Carbon Emission Neutral
	Conservation	– Guardians activity – Routine check and materialization	– Reinforcing responsiveness to diverse factors – Minimize risk factors	– Carbon Emission Minimize – Carbon Emission Minimize
	Capacity Building	– Share professional resources – Routine training	– Awareness change on risk factors – Minimize risk factors	– Carbon Emission Neutral – Carbon Emission Minimize
	Communication	– Communicate with stakeholder – Interaction with multi-stakeholder	– Simplify administrative costs – Simplify decision making	– Carbon Emission Neutral – Carbon Emission Minimize
	Community	– Community-based suggestion – Reducing the generational gap	– Daily esponse ro climate change possible – Securing consensus between generations	– Carbon Emission Neutral – Carbon Emission Neutral
Local Government	Credibility	– Survey reasearch support – Administrative support	– Cost reduction – Streamlining administrative procedures	– Carbon Emission Neutral – Carbon Emission Neutral
	Conservation	– Encouraging community envolvement – Documentation support and publicity	– Reduce CC risk factor – Cut climate cost by minimizing operation cost	– Carbon Emission Neutral – Carbon Emission Neutral
	Capacity Building	– Expert recruitment and support – Cooperation in education and training	– Streamlining administrative procedures – Reduce climate change risk factor	– Carbon Emission Neutral – Carbon Emission Minimize
	Communication	– Stakeholder cooperation and coordination	– Simplify decision-making – Reduce climate change risk factor	– Carbon Emission Neutral – Carbon Emission Neutral
	Community	– Community consultation – Incentives for voluntary participation	– Securting consensus among stakeholders – Simplify administrative costs	– Carbon Emission Neutral – Carbon Emission Minimize

Source: Author's proposal, page 20-1. Note: "5Cs" refers to the five criteria used to create a framework for and evaluate the proposed the King Jayavarman VII Royal Parade. The five criteria are: credibility, conservation, capacity-building, communication, and community.

Carbon emission rights accredited to World Heritage sites, significance at the international level

The application of carbon-emission rights in World Heritage Zones is considered a highly theoretical topic of interest to numerous stakeholders. Of course, these rights are applied differently depending on the type of world heritage classification—natural, cultural, or complex—as well as the scope of the legal entity that enforces classification regulations in the country where the site is located. In Korea, the development and utilization of sites in a World Heritage Zone are restricted to the various laws and enforcement ordinances listed in Table 4.11. Under these various laws and ordinances, the land itself cannot be altered or used for commercial purposes. This has the effect of permanently reducing GHGs in heritage-protected areas as well as historical and cultural areas.

In the United States, there has been much research around carbon absorption and the energy-saving effects of urban green areas. One study has estimated the annual carbon dioxide absorption and absorption effect of urban trees in the United States at 22.8 metric tons per year.[12] One key effort that could go a long way towards this reduction is the Climate Action Team of California's 2006 project to plant 3 million trees in Los Angeles, one of the largest and most populous cities in the United States.[13]

Table 4.9 Selected urban tree planting projects in the United States and their carbon dioxide absorption effect

	Carbon-dioxide absorption			
Project	CO_2 tons/ year	Kg of CO_2/tree/ year	**Objective**	**Source**
Million Trees LA	28,571	29	1 million trees to last for 35 years; target of 1 mt of CO2 absorption	McPherson et al., 2007
Million Trees NYC	5,327 ~21,754	0.89~36	220,000 trees planted and 380,000 trees used for reforestation (estimated for 15 years after initial planting)	Moore, 2009
Sacramento Shade Program	8,750	47	-	Simpson and McPherson 1998
Colorado tree Planting	-	150~225* 75~100**	* Includes energy savings **Without energy savings (tree growth effect)	McHale et al., 2007

Source: Park, 2009.

Although this research on the carbon-absorption capacity of forests and green areas is conducted from the perspective of reducing the temperature of the city center, and not in connection with cultural heritage, urban forests have been recognized as important levers for carbon absorption in the process of adopting the Kyoto Protocol in 1997. Since then, the 2001 Marrakesh Agreement separately stipulates the definition of forests that can be recognized for carbon-emission rights during the first pledge period (2008-2012). From this point of view, the results of research on urban parks in Korea (Table 4.10) demonstrates that proposed carbon-emission rights accredited to Cambodia's World Heritage site at Angkor, which is already surrounded by forest resources, could follow a similar approach.[14]

Table 4.10 Forestation initiatives in selected urban parks in Korea

Park	Location	Year of reforestation	Original area (facility plus forest)(m^2)	Planted forested area (m^2)	Total (m^2)
Bundang Central Park	Bundang-gu, Seongnam-si 65, 66 Sunae-dong	1994	88,924 (37.7%)	147,235 (62.3%)	236,159 (100%)*
Gwacheon Central Park	Byeolyang-dong, Gwacheon-si-2	1994	19,320 (40.2%)	19,320 (40.2%)	28,688 (59.8%)
Suwon Hyowon Park	Paldal-gu, Suwon-si 1117 Ingye-dong	1994	42,6642) (23.9%)**	42,6642 (23.9%)	136,000 (76.1%)
Anyang Citizens' Park	Manan-gu, Anyang-si Anyang-dong	2006	61,301 (62.1%)	61,301 (62.1%)	37,491 (37.9%)***

Source: Calculation of Carbon Dioxide Absorption in Urban Trees and Improvement of Absorption Effect, 2018. Note: * = Forest area (184,792m2) excluded. If forest area is included, the facility area ratio is 21.1%. ** = Excludes the Cultural Center (48,000m2) from the facility area. If the Cultural Center is included, the facility area ratio is 40.0%. *** = Excludes forest area (2,446m2). If forest area is included, the facility area ratio is 60.6%.

However, in order for this proposal to get off the ground—let alone succeed—it needs to adhere to and cooperate with two specific World Heritage and Carbon Disclosure Mechanisms. First, World Heritage sites around the world are assessed/designated by the United Nations Educational Social and Cultural Organisation (UNESCO) and each site's OUV (Outstanding Universal Value) is maintained by local and central governments, while local communities inherit and help to maintain its OUV. Table 4.11 lists the different types of laws and regulations that apply to cultural heritage and its surroundings.

Table 4.11 Laws and regulations governing World Heritage designation

Law or regulation	Applied area
Cultural Heritage Protection Act	Establishment of plans related to cultural properties
Tourism Promotion Act	
Cultural Heritage Protection Act	Historical and cultural environment review
Laws related to land planning and use	Maintenance of ruins
Act on Acquisition and Compensation for Land, etc. for Public Works	
Cultural Heritage Protection Act	Reserved area (permit, report, administrative order)
Ordinance on the Protection of Regional Cultural Heritage	
Enforcement Rules for Protection of Regional Cultural Heritage	
Museum and Art Gallery Promotion Act	Related to auxiliary facilities
Museums and Art Galleries Ordinance	
Local government enforcement ordinance	
World Heritage Law	World Heritage related
National Park Act	Heritage sites inside national parks

Source: Republic of Korean National Heritage Laws, UNESCO Database of Natural Cultural Heritage Laws, https://whc.unesco.org/en/statesparties/kr/Laws.

Although application of the laws and sub-decrees described in Table 4.11 may differ from country to country, efforts to preserve, maintain, inherit, and utilize cultural heritage sites or cultural values are achieved through dynamic cooperation between central governments, regional governments, and, especially, local governments in order to take into account local characteristics.

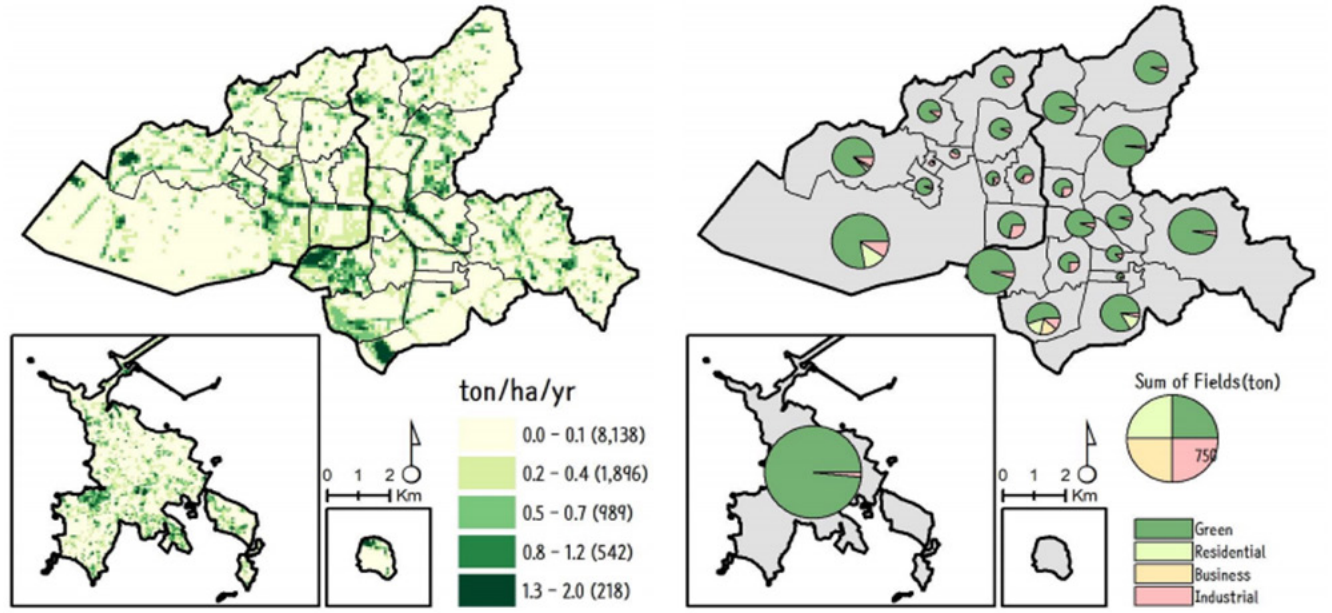
Second, as discussed in earlier sections, many countries are coming to realize that one of the most important measures to respond to climate change is the preservation and management of urban green spaces. For example, the United States and the United Kingdom have introduced the concept of green infrastructure and resources as an important element of urban-planning and have already begun systematically managing urban green facilities. Accordingly, Korea has established a policy goal to expand green spaces by creating urban forests, roadside trees, and meditation forests, as well as by identifying new reforestation targets to promote carbon sinks.

Although local governments in Korea are implementing policies such as expanding urban forests and planting street trees to respond to climate change, application of these initiatives to cultural heritage is still a way off. However, urban green areas are now included in the "residential area" category among the six land-use sectors, which include cultural heritage, along with its surrounding environment, according to the United Nations Framework Convention on Climate Change (UNFCCC). A so-called "historical and cultural district" contributes to reduction of artificial carbon emissions not only by limiting changes in the shape of the land, including through height restrictions, but also by requiring authorities to maintain the heritage site's surrounding natural environment, which is a positive factor for the carbon neutrality of the area. This UNFCCC standard could be seen as an incentive for Korea as well as developing countries to include climate-change initiatives in their efforts to promote and maintain cultural heritage assets.

One example of a Korean city's experiment with blending climate-change and cultural heritage promotion is in Ansan. An annual carbon sequestration map of urban green spaces in Ansan[15] shows that the city's land-use area can be divided into 1) residential space, including single-family and multi-household homes; 2) commercial and industrial areas, including commercial, industrial, public land, and transportation areas; and 3) green areas such as amusement parks, natural areas, and parks. As mentioned earlier, cultural heritage expressly limits land use to preserve its value. It can be argued that the effects of carbon absorption contribute to carbon neutrality of cities.

To date, no independent study on the effectiveness of carbon neutrality centered on cultural heritage has been carried out. However, results of local studies that have included cultural heritage do indicate that culture heritage should be considered a sufficiently feasible category in any analysis of carbon neutrality. Furthermore, cultural heritage assets should be granted carbon-emission rights, differentiated by the nature of the property and its surrounding environment.

Figure 4.6 Annual carbon sequestration in green areas in Ansan City



a) Annual carbon sequestration (Method 1) **b) Results of the administrative district (Method 1)**

Source: Estimation of Carbon Sequestration in Urban Green Spaces Using Environmental spatial Information: A case study of Ansan City, 2018.
Note: (a): shows carbon sequestration throughout Ansan City; (b) refers to carbon sequestration by land usage. Amounts are shown in tons of carbon per hectare per year. Left: the darker the area, the more carbon sequestered.

One possible location of a World Heritage site that could accommodate a carbon-emissions reduction project is Cambodia's Angkor archaeological. See Table 4.12 for an outline of a proposal for this project.

Table 4.12 5C analysis (at the local community and government level) of a proposal for carbon credit accreditation of World Heritage sites

Level	5Cs Criteria	Role & Responsibility	Climate Change Aspect	Carbon Reduction Aspect
Community	Credibility	– Literature survey reasearch – Discover community-based stories	– Do not need any physical structure – Typifocation of intangible elements	– Carbon Emission Neutral – Carbon Emission Neutral
	Conservation	– Guardians activity – Routine check and materialization	– Reinforcing responsiveness to diverse factors – Minimize risk factors	– Carbon Emission Minimize – Carbon Emission Minimize
	Capacity Building	– Share professional resources – Routine training	– Awareness change on risk factors – Minimize risk factors	– Carbon Emission Neutral – Carbon Emission Minimize
	Communication	– Communicate with stakeholder – Interaction with multi-stakeholder	– Simplify administrative costs – Simplify decision making	– Carbon Emission Neutral – Carbon Emission Minimize
	Community	– Community-based suggestion – Reducing the generational gap	– Daily esponse ro climate change possible – Securing consensus between generations	– Carbon Emission Neutral – Carbon Emission Neutral
Local Government	Credibility	– Survey reasearch support – Administrative support	– Cost reduction – Streamlining administrative procedures	– Carbon Emission Neutral – Carbon Emission Neutral
	Conservation	– Encouraging community envolvement – Documentation support and publicity	– Reduce CC risk factor – Cut climate cost by minimizing operation cost	– Carbon Emission Neutral – Carbon Emission Neutral
	Capacity Building	– Expert recruitment and support – Cooperation in education and training	– Streamlining administrative procedures – Reduce climate change risk factor	– Carbon Emission Neutral – Carbon Emission Minimize
	Communication	– Stakeholder cooperation and coordination	– Simplify decision-making – Reduce climate change risk factor	– Carbon Emission Neutral – Carbon Emission Neutral
	Community	– Community consultation – Incentives for voluntary participation	– Securting consensus among stakeholders – Simplify administrative costs	– Carbon Emission Neutral – Carbon Emission Minimize
Inter National	IUCN WWF	– Carbon Credit Accreditation Procedure – Credit Accreditation		

Source: Author's proposal, p. 24-1. Note: "5Cs" refers to the five criteria used to create a framework for and evaluate the proposed carbon credit for accreditd World Heritage sites program. The five criteria are: credibility, conservation, capacity-building, communication, and community.

Gimnyung village, Jeju Island – KRIHS

CHAPTER 5

Jeju Island Case Study

Sustainable Island and Sustainable Tourism

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Introduction

Emissions of carbon dioxide and other GHGs as a result of human activity are one of the most significant contributors to climate change, including global warming, and represent one of the most pressing challenges facing the world today. Since the beginning of Earth's history, there has been a correlation between the levels of GHGs in the atmosphere, particularly carbon dioxide, and average global temperatures.

The tourism industry is extremely susceptible to the effects of climate change and is at the same time a contributor to the emission of GHGs. To transform tourism into an industry that meaningfully responds to climate change requires the adoption of a low-carbon pathway, which includes changes in tourism policies and the institutions that manage and govern them, changes in visitor behavior, and action on climate change as key components. This chapter uses the example of Jeju Island to demonstrate how to secure a connection between the response to climate change and the promotion of sustainable tourism.

More specifically, Jeju Island provides an example of how low-carbon tourism can be a productive and effective strategy for reducing the effects of climate change. GHG emissions reduction is both the most effective and fundamental strategy for combating global warming. To cut emissions globally, there are two imperatives. The first step is to lower the amount of GHGs released into the atmosphere, and the second step is rid the atmosphere of any GHGs that have already been released. Jeju Island's strategy for mitigating the effects of climate change through low-carbon tourism is anchored in these two efforts.

Due in part to rapid expansion of the tourism industry, Jeju Island has experienced negative effects on both the local environment and the local community. The danger posed by tourism-related activities has grown as a direct result of an increase in both the temperature of the seawater and sea levels. The acceleration of climate change and the growth of Jeju Island's tourism industry are trapped in a vicious circle. Yet, the local government has made changes to systems and policies, various stakeholders are ushering in changes in behavior linked to tourism activities, and climate action is being taken to prevent climate change.

Jeju Island's local government has developed various frameworks and guidelines designed to address these issues. This chapter discusses recent developments in three important institutions, policy changes regarding smart grids and supply of electric vehicles, and standards on green building design.

Behavioral changes by the various stakeholders and visitors directly linked to tourism activities on Jeju Island play an important role in breaking the cycle of harm described in the previous paragraphs. The island's shift to tourism activities centered on three activities—1) long-term stay tourism by means of walking, 2) low carbon footprint food tourism, and 3) marine garbage upcycling—has played an important role in changing people's behaviors. Educating children about the environment has also helped.

Finally, the chapter discusses arguments in favor of taking action to combat climate change centering on the following topics: travel with a small carbon footprint, utilization of renewable wind energy, carbon-neutral renovation of tourist buildings, and the establishment of marine forests. It makes abundantly clear that efforts are being made to both lower GHG emissions and increase absorption of these gases.

The case of Jeju Island teaches us that the success of efforts to combat climate change through climate action depends on the amicable resolution of conflicts between stakeholders who are directly or indirectly related to tourism. The chapter also suggests that any application of Jeju's climate action in developing countries needs to follow a particular process in order to be successful.

Case study rationale and description

Rationale

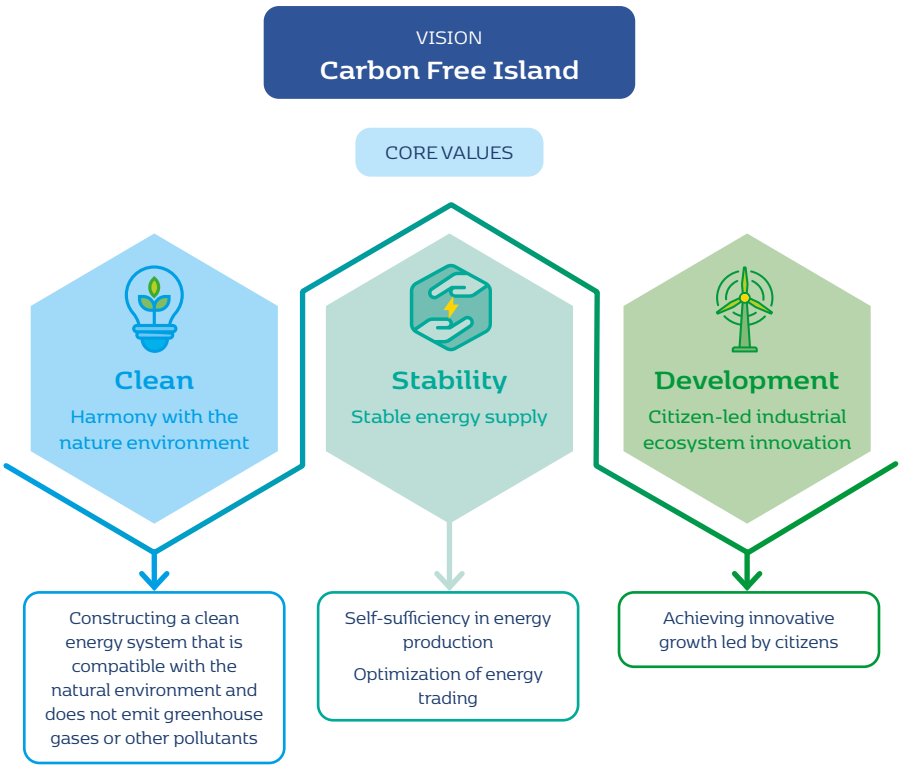
The local government of Jeju Island has been developing detailed strategies and effective action plans to reduce GHG emissions and promote sustainable development in harmony with the economy and the environment.

Climate change is caused in part by increasing carbon emissions, which results in global warming. Therefore, to eliminate the source of climate change, carbon must be eliminated. Two methods exist for removing carbon dioxide from the atmosphere. The first is to minimize carbon emissions and the second is to absorb already created carbon emissions. Pursuing sustainable tourism incorporating these two methods is an ideal strategy to mitigate climate change related to or caused by tourist operations—and Jeju Island tourism is an example of sustainable tourist development based on climate-change mitigation.

Description

The local government of Jeju Island—through its 2030 CFI (Carbon-Free Island) project, established in 2012—aims to create a clean, energy-independent island and promote the sustainable development of Jeju. The project implementation plan is built on three foundational policy objectives: cleanliness, stability, and expansion (Figure 5.1).

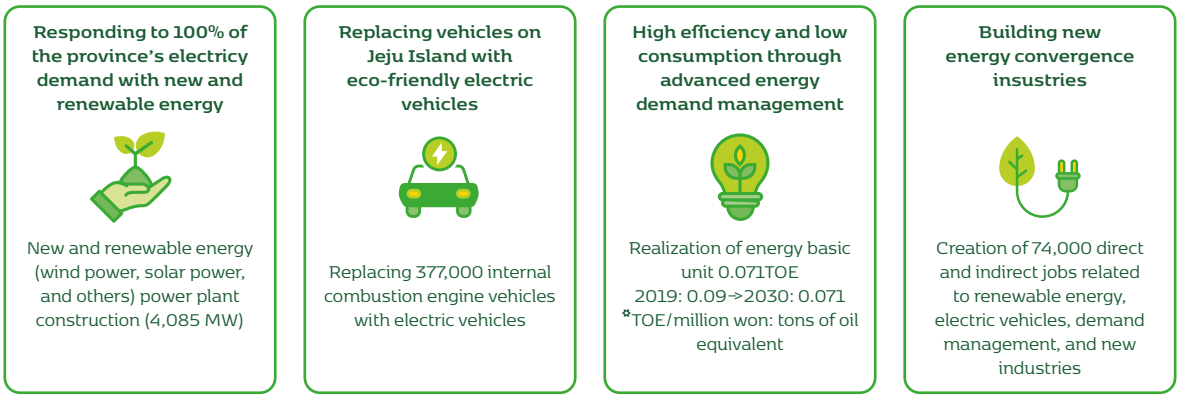
Figure 5.1 2030 CFI (Carbon Free Island): Jeju's core values



Source: Jeju Special Self-Governing Province, 2012.

The first step to realizing this vision was to establish a carbon-free island pilot model, the second is to replace 50% of electricity with new and renewable energy (solar, wind, and others) by 2020, and the third is to have 100% electric vehicles by 2030. In addition, the plan also includes the promotion of a smart grid base district, the establishment of an electric vehicle pilot city, the development of 2 gigawatts (GWs) of offshore wind power, and the establishment of Jeju Energy Corporation.

Figure 5.2 Four policy goals of the 2030 CFI



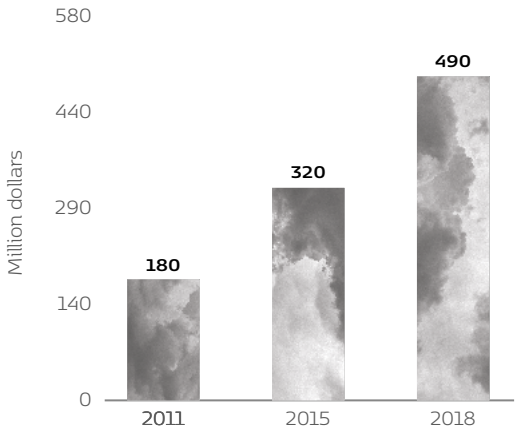
Source: Jeju Special Self-Governing Province, 2012.

Jeju Island's local government has set a goal of creating 74,000 direct and indirect jobs in four sectors: renewable energy, electric vehicles, demand management, and new convergence industries (Figure 5.2). Through energy conversion and the distribution of environmentally friendly electric vehicles, Jeju aims to reduce carbon dioxide emissions by 33.9% by 2030, from the standard 4,203,000 tons to 2,779,000 tons. Jeju is making various efforts to achieve the four policy goals.

Management and development challenges and opportunities

Due to the rapid expansion of the tourism industry on Jeju Island over the last decade, vehicular traffic has increased faster than the expansion of transportation infrastructure, resulting in congestion-related social costs (Figure 5.3). The number of registered vehicles and volume of traffic on major roads also increased significantly, primarily due to an increase in the number of rental cars and commercial vehicles.

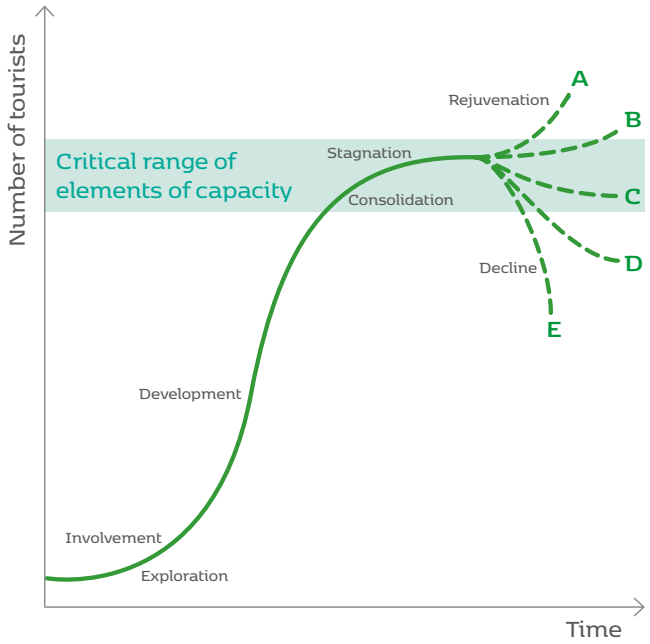
Figure 5.3 Traffic congestion costs on Jeju Island, 2011-2018



Source: South Korea Transport Institute, 2021.

GHG emissions are increasing on Jeju Island, particularly in the transportation sector, which may lead to long-term declines in agricultural, fishing, and tourism productivity. In fact, the transportation sector is responsible for 46.9% of Jeju's GHG emissions—30.1% from roads, 13.3% from aviation, and 3.5% from shipping.[1] As a result, authorities estimate the productivity loss and cost of damage in Jeju as a result of global warming, the damage scale relative to gross regional domestic product (GRDP), and the cost-per-ton of carbon are all greater than in other regions of Korea.[2]

Figure 5.4 Tourism area life cycle theory



Source: Butler, 1980, p.7.

There is also a strong possibility that a large number of commercial facilities will move into some areas of Jeju Island, that congestion issues caused by an influx of tourists will worsen, and that the area's long-term competitiveness as a clean image and tourist attraction may decline. When applied to Butler's (1980) Tourism Area Life Cycle (TALC) theory, it can be argued that tourism in Jeju is in the early stages of the so-called "stagnation" stage as a result of the social costs to the island—economically and environmentally—associated with tourism (Figure 5.4).

Current and emerging threats and impacts from climate change

As was previously stated, tourism is the primary economic driver of Jeju Island and a significant source of foreign-currency income. Tourism on the island is considered a climate-dependent industry as much of the appeal to visitors is the area's natural resources. Because Jeju Island's popularity has increased due to its pleasant climate, the impacts of climate change are having a variety of negative effects on Jeju's tourism industry. Numerous climate-related threats have already been detected in the seas off the coast of Jeju Island.

Threat from rising sea temperatures

Jeju Island's coast has warmed by 0.31°C over the past 21 years according to an analysis of water temperature changes.[3] A rise in seawater temperature caused by global warming is the leading cause of sea desertification, in which the sea becomes more like a land-based desert, with loss of vegetation such as seaweed as well as marine life. Calcium carbonate is only soluble in carbon dioxide-containing water, and the lower the water temperature, the more soluble it is. As seawater temperatures rise, its solubility decreases, and calcium carbonate that is not dissolved eventually adheres to the seafloor and rocks. Seaweeds that inhabit the areas around Jeju Island, such as seaweed, kelp, and Ecklonia, cannot grow if the rock is coated with calcium carbonate. Sea desertification results in the disappearance of seaweeds in coastal rocky areas, and their replacement with limestone algae such as coral reefs, which destroys the entire marine ecosystem. When the rock's surface turns white or red, this is known as a "whitening event." Ocean whitening events, also known as coral bleaching, are caused primarily by rising ocean temperatures and occur when corals expel their colorful symbiotic algae, leaving them pale or white. When corals bleach and die, the entire reef ecosystem is disrupted, leading to a decline in biodiversity and negatively impacting fish populations and other marine organisms that depend on the reef for food and shelter.

Photo 5.1 Whitening event on rocks in the sea off the coast of Jeju Island

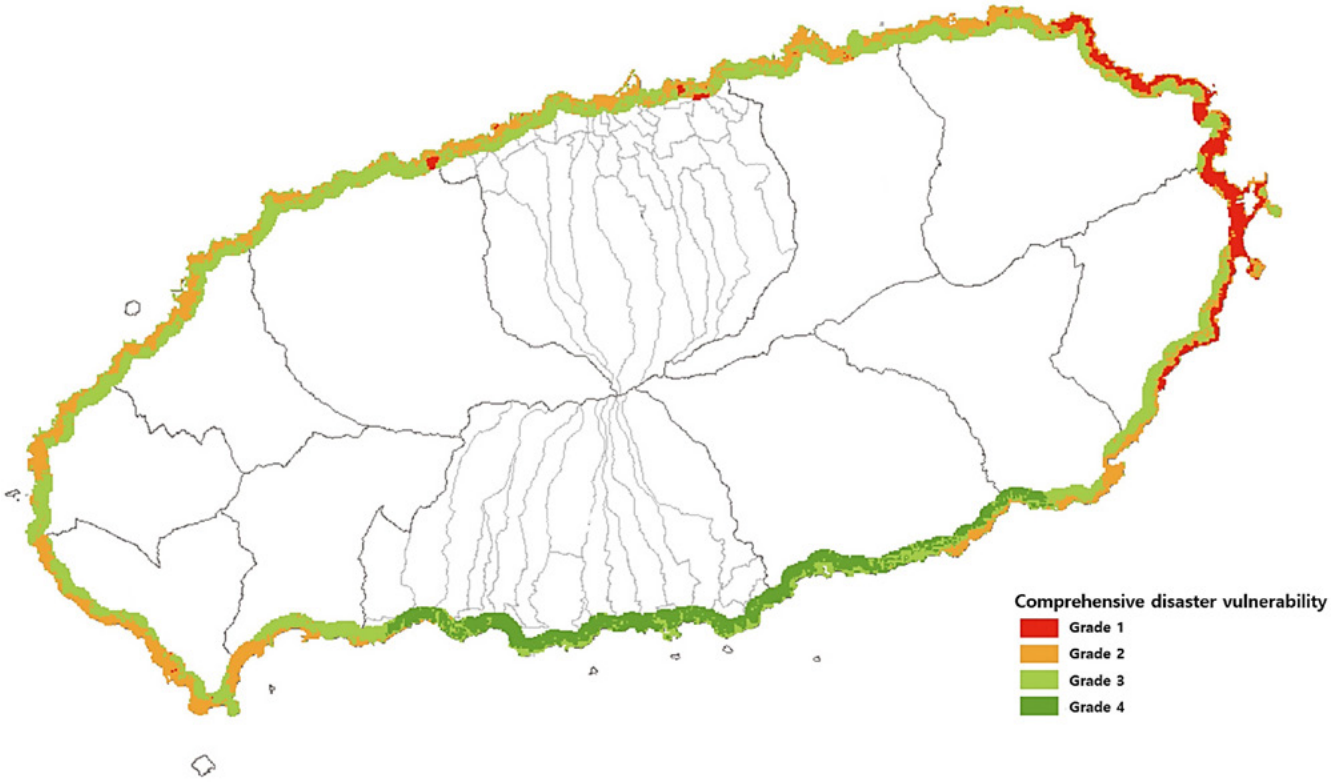
Source: Korea Fisheries Resources Agency, 2017.

The desertification of the sea surrounding Jeju Island will result in the destruction of marine resources and the disappearance of natural attractions. If desertification continues, the island's most popular tourist attraction—its natural coastal and aquatic attraction and marine biodiversity—will vanish, signaling the end of sustainable tourism.

Threat from rising sea levels

According to some studies, 37% of Jeju's coastline is susceptible to natural disasters due to rising sea levels.[4] Map 5.1 depicts the distribution of disaster vulnerability ratings for the areas within 1 kilometer of the coast of Jeju Island, taking into account various factors such as current and future climate change, potential flooding and tsunami damage, population change, development projects, and low-lying terrain. Ratings assess vulnerability due to sea level rise.

Map 5.1 Distribution of general disaster vulnerability ratings



Source: Park, Moon, and Kang, 2020, p. 43.

Rising sea levels result in the loss of sand and flora as well as beach erosion damage on Jeju Island. The loss of sand in particular is a significant issue for tourism on Jeju Island, as severe weather events accelerate natural erosion rates, resulting in a drop in amenity value—characteristics of an area that contribute to its pleasantness and attractiveness—and, in the worst-case scenario, the loss of beach access or unsafe beach profiles. Combined, rising sea levels and severe weather events increase the danger of erosion, which has a significant impact on Jeju Island's sustainable tourism.

Climate strategies and actions for mitigation and adaptation

Institutions and policy changes

This section describes how Jeju Island's local government is creating policies and institutional foundations for reacting to climate change. It is worth noting, in particular, that national-level rules are directly linked to and reflected at the local government level in Jeju Island.

Table 5.1 Relationship between national laws contained in the National Policy Study and Jeju Island local government ordinances

Field	National law	Jeju Island local ordinance
Climate Change	Framework Act on Low Carbon, Green Growth (2010-2021)	Framework Ordinance on the Creation of the World Environmental Capital and Low-Carbon Green Growth
	Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis (2021-present)	Framework Ordinance on Carbon Neutrality and Green Growth to Respond to the Climate Crisis
Tourism	Tourism Promotion Act	Ordinance on the Promotion and Support of Ecotourism
Environment	Environmental Technology and Industry Support Act	Environmental Conservation Fund Establishment and Operation Ordinance

Source: Original table for this publication.

The following sections address the four regulations that underpin the local government's climate change response in the tourism and industry sectors and explain how each local government regulation relates to and is informed by national legislation.

Framework Ordinance on the Creation of the World Environmental Capital and Low-Carbon Green Growth of Jeju Island

In 2010, the Korean government enacted the Framework Act on Low-Carbon Green Growth to create a foundational policy to promote low-carbon green growth for the harmonious development of the economy and the environment. The act also promotes the development of the national economy by utilizing green technology and green industry as new growth engines, to contribute to the realization of a low-carbon society and improve overall quality of life of the people, and to help Korea leapfrog into a mature and advanced country that fulfills its responsibilities to the international community.

The Jeju Island local government enacted the Framework Ordinance on the Creation of the World Environmental Capital and Low-Carbon Green Growth of Jeju Island in 2015 to codify the tasks delegated to local governments in the national Framework Act. The purpose of the Jeju Island ordinance is twofold. First, it establishes the matters necessary to establish Jeju Island as a World Environment Capital. The term "World Environment Capital" is used here to refer to the best or most exemplary of the world's notable environmental cities. Second, the ordinance aims to achieve sustainable development, while responding

to climate change, by comprehensively promoting low-carbon green growth measures.

Framework Ordinance on Carbon Neutrality and Green Growth to Respond to the Climate Crisis of Jeju Island

In 2021, the Korean government passed the Framework Act on Carbon Neutrality and Green Growth to Address Climate Change to mitigate the severe effects of the climate crisis by strengthening GHG emissions reduction and adaptation measures; eliminating economic, environmental, and social inequalities that may arise during the transition to a carbon-neutral society; and achieving harmonious economic and environmental development by fostering, promoting, and activating green technologies and green industries. Furthermore, the act aspires to improve quality of life for present and future generations, protect the ecosystem and climate system, and contribute to the international community's long-term growth in green industries and areas.

One year later, in 2022, the local government of Jeju Island enacted the Framework Ordinance on Carbon Neutrality and Green Growth to Respond to the Climate Crisis of the Jeju Special Self-Governing Province to specify the tasks appropriate to Jeju Island and that have been delegated to local governments in the national-level Framework Act on Carbon Neutrality and Green Growth for Responding to the Climate Crisis.

The provisions and measures of the ordinance provide an institutional foundation for Jeju Island to respond to diverse climate change and carbon neutrality issues by establishing policies that comprehensively consider sectoral emission contributions, industry characteristics, policy feasibility and effectiveness, and impacts on other sectors in order to achieve effective carbon neutrality.

Ordinance on the Promotion and Support of Ecotourism of Jeju Island

The Tourism Promotion Act was passed by the Korean government in 1986, and a provision on sustainable tourism was added in 2009 to reflect the link between tourism and global environmental challenges such as climate change and sustainability. Under this provision, the Korean government is required to fulfill its international obligations to minimize the use of energy and resources, respond to climate change, reduce environmental degradation, and develop sustainable tourism resources that balance the lives of local residents with the need to contribute to local economic development.

The Ordinance on Promoting and Supporting Ecotourism in Jeju Special Self-Governing Province, enacted in 2015 by the local administration of Jeju Island, aims to carry out "sustainable tourism promotion" as defined in the national Tourism Promotion Act. The ordinance attempts to identify the activities required to promote ecotourism in order to develop an ecologically sustainable Jeju society by preserving the environment while simultaneously promoting the welfare of residents. Per the terms of the ordinance, the Jeju Island local government will prepare a Jeju Special Self-Governing Province Ecotourism Promotion Basic Plan every four years to thoroughly, strategically, and efficiently promote ecotourism measures; the action plan will be finalized after considering by the Ecotourism Promotion Committee.

Environmental Conservation Fund Establishment and Operation Ordinance of Jeju Island

In 1994, the Korean government enacted the Environmental Technology and Industry Support Act to promote the development, support, and dissemination of environmental technologies and foster environmental industries to preserve the environment, promote green growth, and sustainably develop the national economy.

In a similar vein to this law, the local government of Jeju Island enacted the Environmental Conservation Fund Establishment and Operation Ordinance in 2006. Through this ordinance, the local government supports six key projects: 1) an environmental conservation master plan and environmental improvement projects; 2) support for local environmental conservation and technology development, investigation, and research activities; 3) funding for the development of environmental

industries such as waste recycling; 4) support for the activities of private environmental organizations; 5) purchase of land which is environmentally valuable; and 6) environmental education and promotion.

At a granular level, the ordinance enables the local government of Jeju Island to conduct research and development on new technologies and innovations that can help change the environment in response to the climate crisis, as well as to implement policies and regulations related to the climate crisis and environmental protection. It also allows the local government to construct the necessary infrastructure and facilities to provide environmental protection, as well as to raise public awareness of the climate crisis and environmental change, and to implement educational programs to educate people about the importance of environmental protection.

Behavioral changes

Government authorities, local citizens, non-governmental groups, tourists, and tourism-related enterprises must all change their behavior for climate actions to be successful. Specific behavioral changes are described in more detail in this section.

Promoting long-term stays through walking tourism

Tourism boosts economies globally, in developed and developing countries, and accounts for nearly 10% of global GDP and one in 10 new jobs worldwide. Yet, tourist destinations must be near multiple transportation options; improved transportation infrastructure improves a neighborhood's access to goods, services, and jobs; and tourists strain infrastructure and services. In fact, 75% of tourism's carbon footprint is from transportation and global tourist transportation emissions reached 1,600 million metric tons of carbon dioxide in 2016, accounting for 5% of total carbon dioxide emissions from energy production.[5] Therefore, incentivizing visitors to remain in one place for an extended period of time may be the most effective strategy for reducing the negative effects of travel on the environment.

Olle trekking on Jeju Island is a popular tourism activity that encourages visitors to stay on the island for an extended period of time (Olle can be translated as "the narrow alley leading to a home from the street" in the Jeju dialect). The non-profit Jeju Olle Corporation designed and branded an Olle hiking trail along the coastline of Jeju Island in 2007. This became a catalyst for more and more hikers to make their way to Jeju to experience the island's renowned natural beauty. As a result, the Olle trail on Jeju has gained notoriety among Korean hikers and is now widely regarded as a popular trekking route. The mountains and natural beauty of the shore and the mountains along the Olle trail is what draws visitors, who can indulge their senses at their own leisure and enjoy the scenery without feeling rushed (Photo 5.2).

Photo 5.2 Tourists trekking along the Olle hiking trail

Source: Jeju Olle Corporation, 2023.

According to the Jeju Special Self-Governing Province Visiting Tourist Facts Survey (2020) conducted by the Jeju Provincial Government, the average length of stay for tourists on Jeju Island is between three and four days. Visitors who come to Jeju for Olle trekking tourism activities were found to stay an average of 10 days, with 65% of their trips being solo excursions.[6] This indicates that Olle trekking is closely associated with low-carbon tourism as long visitor stays, especially for solo travel, minimize unnecessary travel and transportation for tourism activities.

Low-carbon footprint food tourism

Globalization has brought food, health, and economic issues to the forefront of every county's policy portfolio.[7] For example, food consumption is a factor in the calculation of the carbon footprint[8] and the recognition that an emphasis on reducing food miles and fostering connections between local initiatives and consumers should be part of every country's plan to help reduce global carbon production.

Jeju's local government is aware that reducing food miles is directly related to reducing carbon emissions, a major contributor to climate change, and promoting and supporting low-food-mile tourism activities on the island, using the famed Jeju Haenyeo (women divers) as a key focal point to spur interest among visitors.

Photo 5.3 Jeju Haenyeo cooking freshly-caught seafood and selling it to tourists

Source: Author.

Jeju Haenyeo forage for, prepare, and consume seasonal, organic food from the sea around the island—primarily shellfish, seaweed, and kelp. The almost nonexistent carbon footprint of Jeju Haenyeo food is its most distinguishing characteristic. By encouraging tourists to consume Jeju local food, the provincial government of Jeju aims to accomplish two goals: 1) reduce carbon emissions caused by the consumption of Jeju Haenyeo food by tourists, and 2) encourage tourists to recognize the gravity of carbon emissions and participate in the movement to reduce carbon emissions through tourism. To achieve these objectives, the local government of Jeju Island collaborated with coastal village residents to promote Jeju Haenyeo Food Tourism.

Marine garbage upcycling and tourism

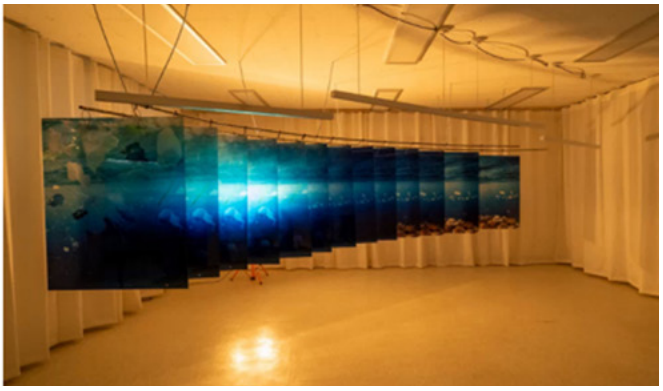
"Upcycling" is predicated on the utilization of technology and manufacturing processes with consideration for the environment and GHGs emissions. Reducing waste-related GHG emissions and the implementation of the so-called "3Rs" (reduce, reuse, recycle) are consistent with the global waste management agenda.[9] The provincial government of Jeju is providing tourists with a unique program that combines diving in the Jeju Sea with upcycling of marine debris and involving interactive educational activities centered on the conservation practices of the Jeju-do Haenyeo.

Photo 5.4 Diving Experience Tour program, where visitors gather marine trash

Source: Jeju Special Self-Governing Province, 2023.

The island's Eco-Run tourism program promotes zero carbon, zero plastic, zero disposable products, and zero waste. Participants enter the water wearing the same wetsuits, goggles, and net baskets as the Haenyeo diving women and, together with Jeju Haenyeo divers, they collect a variety of marine debris, from large items like tires and bicycles to smaller items like waste bottles, toothbrushes, fishing nets and buoys.

Photo 5.5 Art exhibition using collected marine debris



Source: Jeju Special Self-Governing Province, 2023.

The collected marine debris is then used as works of art by artists working on Jeju Island; these works are gathered together into an exhibition that tells the story of how collecting debris from the sea can create an ocean gradually free from pollution. The program allows local governments, non-profit civic groups, and villagers to understand and experience, firsthand, resource circulation through upcycling marine debris.

Ecological education for children

In order to combat climate change, education must play a central role. All parties to the UNFCCC, including the Republic of Korea, are tasked with implementing public education and awareness campaigns on climate change, as well as ensuring public involvement in related programming and access to relevant information.[10]

To help support Korea's national efforts and obligations, the Office of Education of the Jeju Special Autonomous Province has planned and is currently promoting ecological education for children, including the Green Smart Future School program, which focuses on the climate crisis.

The Green Smart Future School project targets 11–14-year-olds with practical actions for carbon neutrality and consists primarily of two programs. The first, Practice for Climate Action 1.5°C, is administered in accordance with the Climate Action 1.5°C application, which teaches children how to recognize the importance of climate action by participating in a climate action quiz contest utilizing a climate action journal and a climate action-related quiz.

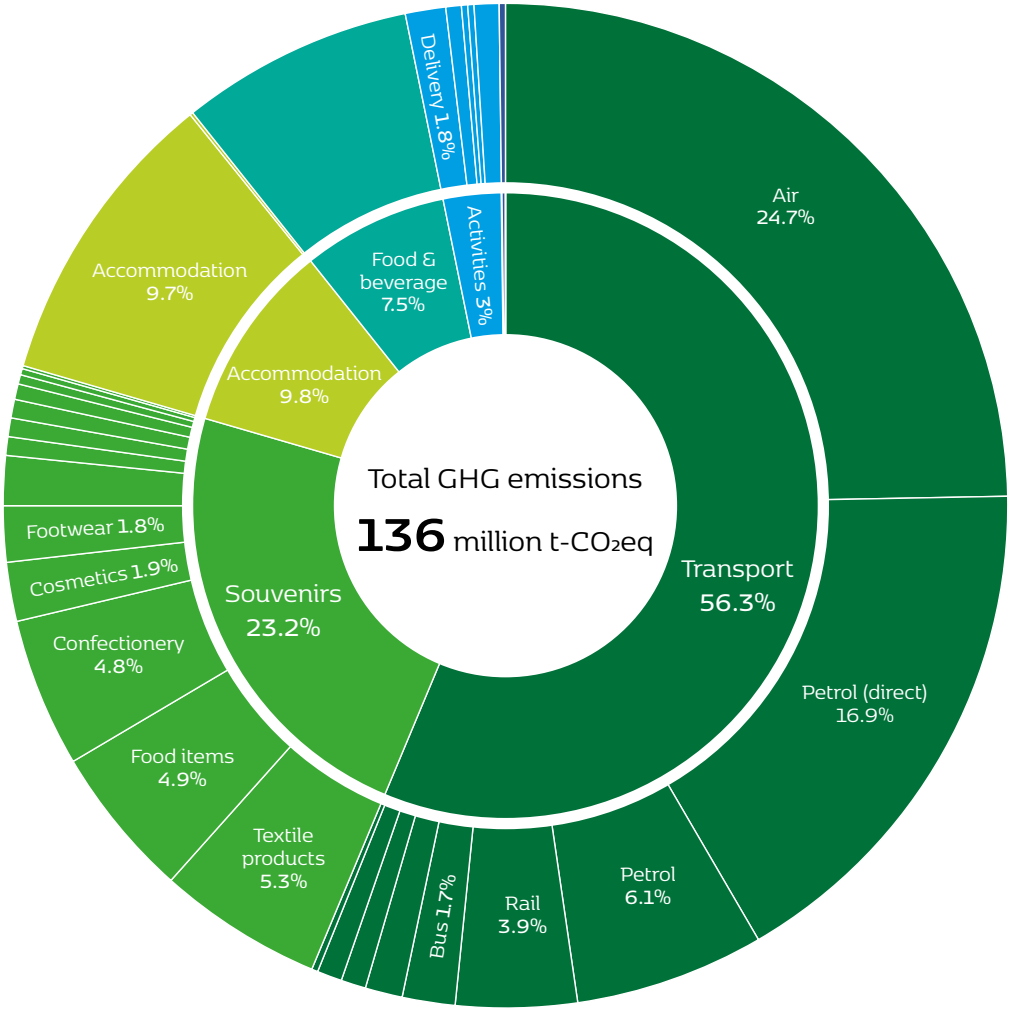
Carbon Piggy Bank is the second program and refers to activities such as school forests, vegetable gardens, and gardens and ponds that can reduce the amount of carbon already emitted. In response to the climate crisis, a school's physical space will be redesigned, and unused school land will go toward constructing an ecological environment learning center. Through the activities of the Carbon Piggy Bank program, children gain knowledge on how to create an environment that reduces carbon.

Climate actions

Flight with low carbon footprint

Air travel is responsible for a minimum of 2.5% of all annual GHG emissions globally,[11] and since air travel is the primary mode of transportation for tourists visiting Jeju Island, emissions from airplanes are also a major concern for Jeju Island's tourism industry.

Figure 5.5 Total GHG emissions, by selected tourism industry sector



Source: Kitamura, et al., 2020, p. 7.

Jeju Air, established as a joint venture between the provincial government of Jeju Island and Aekyung Group, is a popular airline among visitors to Jeju Island. The two partners established two strategies for Jeju Air to address the impact of climate change. The first objective is to promote and support the introduction of sustainable aviation fuel (SAF), a biofuel made from renewable biomass and waste materials that is designed to leave less of a carbon footprint than conventional petroleum-based jet fuel. Depending on the sustainable feedstock utilized (such as food crops or organic waste), manufacturing process, and the efficiency of the supply chain that transports the fuel to the airport, SAF is thought to reduce carbon emissions by as much as 80% relative to the conventional jet fuel it substitutes.[12]

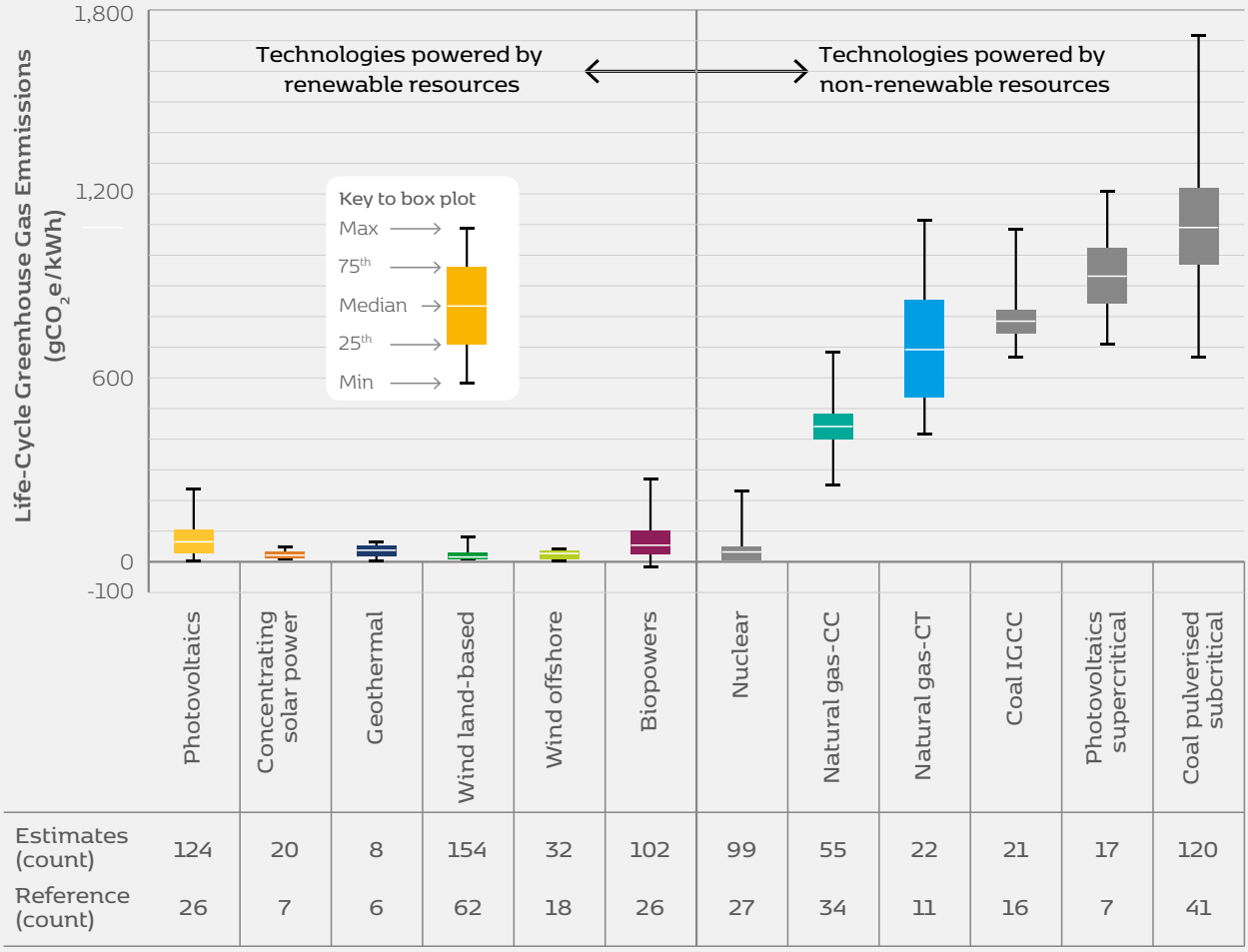
The second of Jet Air's climate action strategies is the utilization of carbon brakes. The airline is replacing aircraft brakes with carbon brakes that are lighter in weight than existing steel brakes in an effort to reduce carbon emissions. By replacing steel brakes with carbon brakes, each aircraft's weight is reduced by 320 kg, which reduces fuel consumption. For example, on a typical one-way Seoul-Jeju service, 11.52 kg of fuel is saved, and carbon dioxide emissions are reduced by 36.4 kg.

The initiative began in 2019 with the replacement of brakes on four aircraft, followed by five in 2020, and 12 in 2022. So far in 2023, brakes on three aircraft have been replaced, bringing the total number to date of aircraft in operation with carbon brakes to 24. In the past year, when 21 aircraft were equipped with carbon brakes, the airline saved 160 tons of fuel, resulting in a 505-ton decrease in carbon emissions.

Utilization of renewable wind energy

Life-cycle GHG emissions are the most accurate measure of carbon dioxide output because they account for emissions made at every stage of the product, process, or technology lifecycle, from initial development to final disposal. Wind-powered electricity generation is unique in that no carbon dioxide is released into the atmosphere. Figure 5.6 compares GHG emissions from a variety of electricity-generation processes.

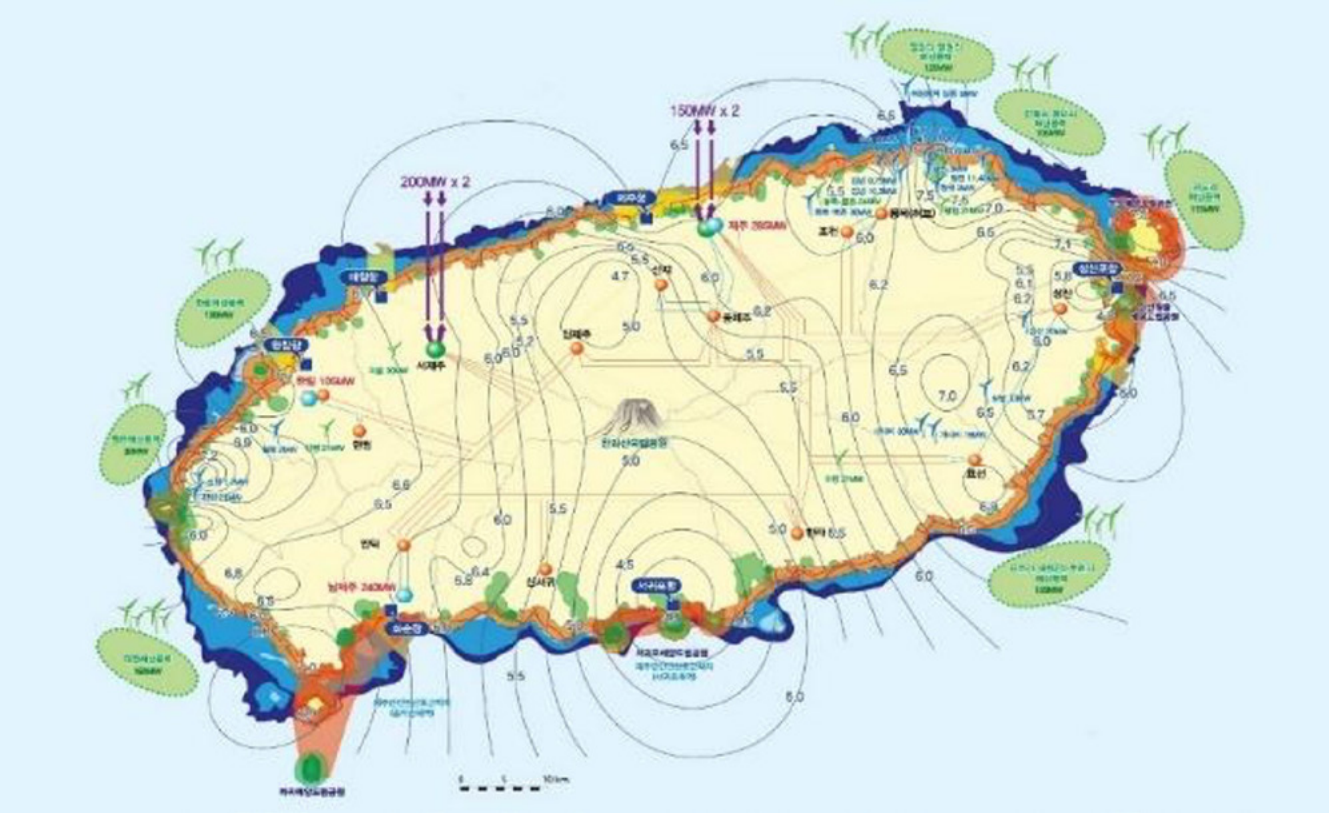
Figure 5.6 Estimates of life-cycle GHG emissions from electricity generation technologies



Source: Zayas, 2015, p. 183.

In Korea, the Jeju Special Self-Governing Province has a higher renewable energy penetration rate than the national average. Since the launch of the CFI policy in 2012, Jeju Island has actively promoted new and renewable energy projects under the Energy Independent Island initiative, which has helped raise the proportion of renewable energy generation from 4% of the total in 2011 to 13.5% in 2019. Wind-energy generation is the largest of these renewable energy industries; authorities are actively taking advantage of the peculiarities of the windy regions of the island.[13]

Map 5.2 Distribution of wind power generation on Jeju Island



Source: Jeju Special Self-Governing Province, 2023.

To date on Jeju Island, 22 wind power plants have been completed, generating 294 megawatts (MW) of electricity production, with 10 more under construction (scheduled to produce 720 MW of electricity). The majority of Jeju's wind farms have been built near the coast; electricity generated there is collected at mid-mountain substations and then transmitted to the specific area assigned to each substation.

Photo 5.6 Wind power plant off the coast of Jeju Island

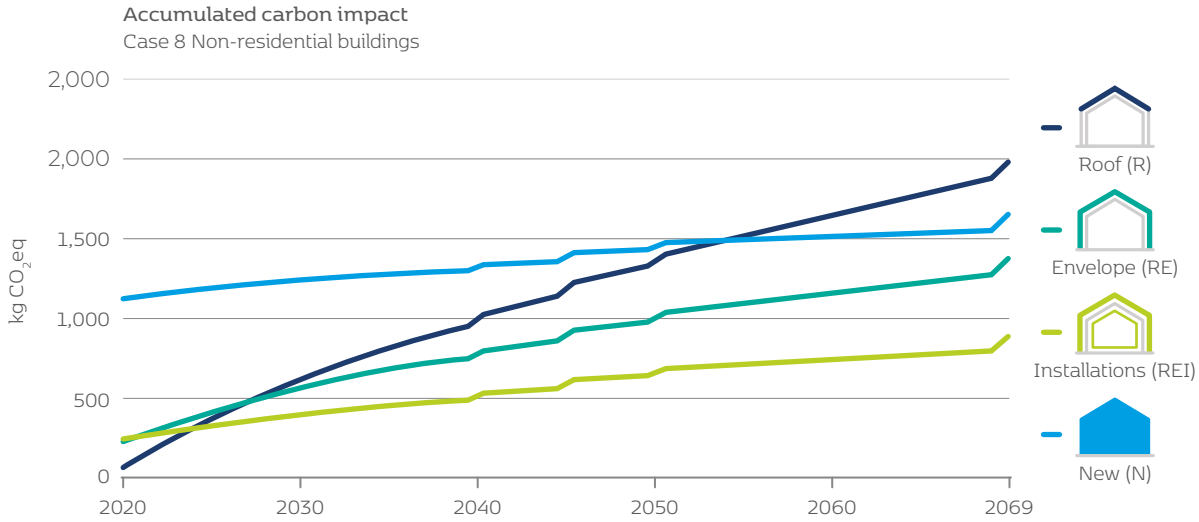
Source: Author, 2023.

Most of Jeju's coastal tourist destinations now use electricity generated by wind power plants, indicating the island's shift away from energy derived from fossil fuels like petroleum. Because of this shift, the tourism industry—and the islands' overall economy—is likely to be less susceptible to the ebbs and flows of oil prices and the negative effects of burning fossil fuels in a fragile ecosystem. Agencies and companies catering to eco-friendly tourists who are ready to pay a premium for the island's sustainable tourism experiences believe that the switch to renewable energy would offer extra profits.

Carbon-neutral renovation of buildings servicing and catering to tourists

Jeju's local government is considering incorporating carbon emission reduction objectives and efforts in the construction of various buildings at tourist destinations—buildings such as restaurants, dining halls, lodges, etc.

Figure 5.7 Cumulative climate impact over the lifetime of a commercial building, in carbon kgs



Source: Norn, 2020, p. 10. Note: (R) = roof renovation, (RE) = exterior wall renovation (including windows), (REI) = renovation of the entire climate screen and technical installations, (N) = brand-new construction.

Figure 5.7 illustrates the climate impacts during the lifetime of a building. Renovation scenarios have relatively high carbon emissions during the first half of the observed period, while emissions gradually become more uniformly steady. However, in the first 30 years after construction, new-build carbon emissions are shown to be significantly higher than those of renovation. Prioritizing repairs over new construction can help the effort to reduce GHGs. This is further supported by the fact that the data indicating impacts in 2020 is real data. The rest of the curve, however, is based on future projections, such as material lifetimes, building operational consumption, and energy-supply composition.

The renovation of a building focusing on Jeju Haenyeo cuisine, with its low food-mile footprint, is a good example. To prepare a space for Jeju Haenyeo food tourism, Jeju's provincial government renovated an abandoned warehouse building on the beach, rather than constructing a new building. In the 1970s and 1980s, the abandoned warehouse served as a fishing market for Haenyeo. The building was later abandoned in the 21st century when the market relocated to a more modern location. The provincial government then renovated the market's original structure to utilize it for Jeju Haenyeo food tourism while attempting to reduce carbon emissions.

Photo 5.7 Energy-saving insulation glass and natural light employed for inside lighting

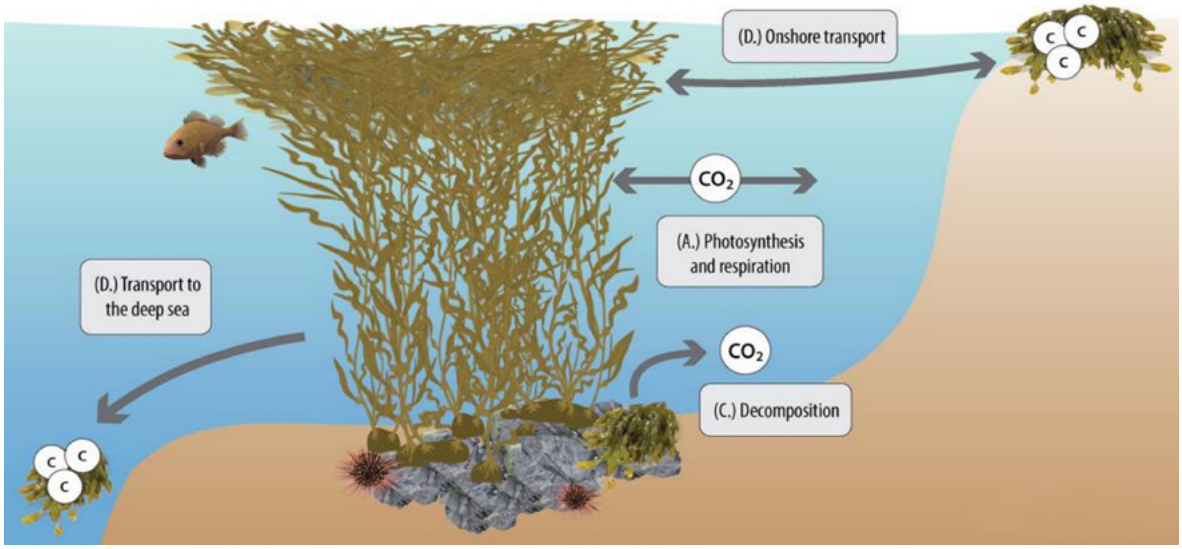
Source: Author, 2023.

The building's renovation design explicitly aimed to reduce carbon emissions. For instance, the design called for installing insulating glass on the building's walls and to reduce heating costs and utilizing indoor natural light to reduce electric energy consumption. In addition, the interior was designed with discarded stones and collected marine debris.

Creation of marine forests

Coastal ecosystems store large amounts of carbon; they can store up to 20 times more carbon per acre than land forests. Macroalgae, otherwise known as seaweed, have gas-filled bladders that allow them to float to the surface and absorb more sunlight for photosynthesis (Figure 5.8), and enable them to float for long distances far from where the macroalgae is grown. As they travel across the ocean, macroalgae remain largely uneaten because they contain unpalatable compounds. When the bladders rupture, the macroalgae sink to the deep-sea floor where carbon is thought to be stored for hundreds or even millions of years, keeping it out of the atmosphere.[14]

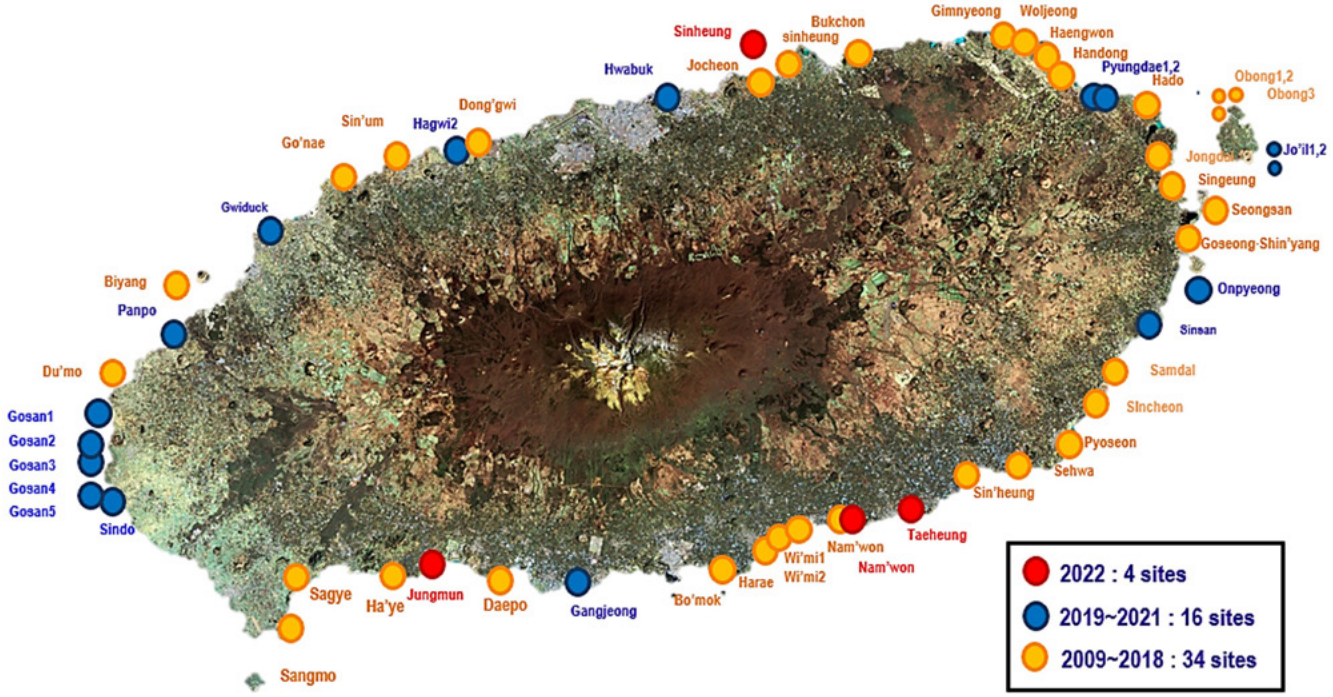
Figure 5.8 Pathways for sequestration of macroalgae carbon into the deep sea



Source: Nielsen, et al., 2018, p. 6.

Since 2009, the Jeju Provincial Government and the Korea Fisheries Resources Agency have created approximately 9,948 hectares of marine forest along much of Jeju's coastline, based on scientific evidence that macroalgae are very effective at removing previously emitted carbon.

Map 5.3 Distribution of marine forest formation along Jeju Island's coast, 2009-2022



Source: Jeju Special Self-Governing Province, 2023.

The forest was created by laying artificial reefs within 15m of water at various points along the coastline. The reefs serve as an ecological foundation for the forest habitat, spawning the growth of the marine ecosystem's most important aquatic resources. The sea forest on Jeju's coast was discovered to absorb approximately 33,525 tons of carbon dioxide per year (3.37 tons CO_2eq/ha), equivalent to the amount of carbon dioxide emitted by approximately 22,000 cars. It features prominently in Korea's national GHG reduction goal for its part in responding to the climate crisis as a carbon sink, in addition to its role as aquatic life habitat and spawning grounds for various fish species and other marine life.

Photo 5.8 Process of forming a marine forest under the sea

Source: Jeju Special Self-Governing Province, 2023.

Given Jeju's island status and abundant natural wonders, the majority of its tourism industries rely on marine tourism resources. If these resources fail, so too will the island's broader tourism industry. The construction of the Jeju Island marine forest has been an attempt to mitigate such threats.

Lessons learned from tested climate actions

Potential for conflict among stakeholders

A key part of the Jeju Provincial Government's policies and efforts to link climate-change mitigation and tourism revitalization has been stakeholder input in establishing concrete projects, steps, and tactics to realize this vision. Key stakeholders are listed in Table 5.2.

Table 5.2 Stakeholders involved in the promotion of Jeju tourism based on climate change mitigation

Government sector	Jeju Special Self-Governing Province
Private sector	Cultural tourism content planning expert group Wind power facility industries
Civil society	Jeju Tourism Association NGOs (environmental protection organizations)

Source: Original table for this publication.

Conflicts among stakeholders are not uncommon, and disagreements with wind power stakeholders in particular have been widespread. The main point of contention has been the potential privatization of electricity generation on the island. If all profits from wind-generated electricity sales were returned to private companies, this shared resource would eventually become privatized. That's why the Jeju local government enacted the Jeju Special Self-Governing Province Wind Resources Sharing Fund Ordinance, after consulting with private companies in charge of wind-power generation facilities and operations, the Jeju Haenyeo Association, Jeju residents, and the Jeju Provincial Council.

Under the terms of the ordinance, wind-energy businesses are to donate 17.5% of net revenue to the development profits fund, which is used by coastal villages to encourage the development, promotion, spread, and use of new and renewable energy, particularly among vulnerable populations in coastal villages.

Role of local governments as conflict mediators

Jeju Island tourism activities based on climate-change mitigation were launched successfully due to amicable management of project conflicts, especially those relating to wind-power generation. This was due in part to the provincial government's creation of the Conflict Mediation Council, which pledged to resolve conflicts through six basic steps:

1. *Basic preparation*
2. *Constituting the council*
3. *Preparation of basic operating rules for the council*
4. *Commencing the coordination of the council*
5. *Preparing a draft consultation*
6. *Developing an agreement*

In Step 1, a working team clarifies and resolves conflicting opinions. Step 2 determines whether additional stakeholder participation is needed to manage the conflict; a mediator may be chosen to resolve stakeholder disputes. Step 3 sees working-level officials and stakeholders agree on basic operating rules for the council, followed by, in Step 4, outlining the agenda and issues for discussion and periodic meetings for further discussion and consensus-building. Step 5 involves stakeholders discussing and mediating issues, and initial drafting of an agreement. Finally, Step 6 involves drafting a final agreement together.

Through conflict management and agreement by multiple parties, Jeju tourism stakeholders see a path forward to successfully improving the island's sustainable tourism project.

Jeju's top three recommendations to developing nations for making their industries less carbon intensive

To reduce tourism's carbon footprint, it is necessary to implement policies and systems that promote the development and adoption of low-carbon technologies, processes, and practices. However, in developing nations such policies and systems are frequently impeded by factors such as the dominance of carbon-intensive practices in the tourism industry and economic structures that prioritize short-term economic development over long-term sustainability.

To create policies and systems that promote less carbon-intensive tourism in developing countries, it is necessary to challenge the hegemony of tourism businesses that contribute to high carbon emissions and to foster an environment conducive to sustainable alternatives. Tourism industries that contribute to high carbon emissions are frequently endowed with substantial political and economic influence, allowing them to resist efforts to transition to more sustainable practices. Based on the examples provided in earlier sections of this chapter, Jeju offers developing countries three important suggestions.

First, it is imperative that a country overcome this hegemony, by simply acknowledging that the tourism sectors that contribute to high carbon emissions frequently have close connections to political elites and use their influence on shape policies and regulations in their favor. This hegemony can make it challenging to develop policies and institutions that prioritize sustainability over short-term economic gains. Yet, coalitions of stakeholders committed to advancing a particular policy or agenda must be formed. They may include relationships with community organizations, advocacy groups, labor unions, and other civil-society actors. Through collaboration, these organizations can expand support for their agenda and exert greater pressure on policymakers to act in favor of less carbon-intensive tourism practices.

Second, securing funding and persuading the public is critical. Tourism industries that contribute to high carbon emissions may be resistant to change out of concern for the cost of transitioning to low-carbon alternatives—and developing nations frequently have limited financial resources and may be hesitant to investing in new technologies and processes they may view as expensive or hazardous. To surmount these obstacles, one key initial step is to persuade the public, as public support is required to generate political momentum for low-carbon tourism and the political will to fund it. If a social problem is deemed minor or unimportant by the general public, it can be challenging to secure the necessary funding to resolve it. On the other hand, it may be simpler to secure funding if the public perceives a social problem as urgent or widespread. Public persuasion can assist in shaping public perceptions of social issues and generating support for investment in these areas.

Finally, it is recommended to educate students on the climate-change crisis. Developing countries may find it difficult to offer educational programs about climate change due to a lack of infrastructure for the development and distribution of educational materials, teacher training, and effective program implementation. To overcome these obstacles, three approaches are required. First, it is important to create alliances. Partnerships between governments, non-governmental organizations, and international organizations can effectively mobilize resources and expertise to support climate-education initiatives in developing nations. By merging resources and knowledge, these partnerships can assist in overcoming resource and capacity limitations to develop effective education programs. Second, investing in teacher training can increase educators' capacity to teach climate science and environmental education effectively. This can include climate science training, the development of educational resources and materials, and ongoing support and mentoring for educators. Third, creating educational materials that are culturally appropriate and pertinent to the local context can increase student engagement and support for climate education initiatives. This may involve collaborating with local communities and educators on materials sensitive to local customs, traditions, and values.

Replicability of Jeju Island's climate actions, particularly for developing countries

The availability of resources—including financial resources, people, and infrastructure—is an important factor to consider. Due to their limited resources and capacity, it may be difficult for developing nations to implement and maintain policies requiring a substantial amount of money and manpower.

Therefore, policies that are basic, cost-effective, contextually appropriate, and that can be efficiently implemented, given the available resources and infrastructure, are more likely to be successful. At the same time, governments in developing nations should carefully consider their countries' unique requirements and obstacles and collaborate with local stakeholders and communities to develop policies that are tailored to the local context.

Replicating long-term stay tourism by means of walking

Walking-based long-term tourism can be viewed as an appropriate solution to replicate in developing nations. As discussed in an earlier section, Olle traversing does not require a substantial budget or labor force. There are three significant causes for this. Similar to the Olle Trek, trails and hiking trails require minimal **infrastructure**, such as signage, trail markers, and fundamental amenities such as restrooms and water fountains. Nor do they require costly infrastructure like rides, hotels, or restaurants, unlike other forms of tourism, such as theme parks and resorts. Second, compared to other forms of tourism, the **maintenance** required for trekking trails and trails is very low. Trails do require regular inspections, repairs and debris removal; but, unlike amusement parks and zoos, they do not require ongoing management. Finally, simple forms of tourism such as Olle trekking frequently rely on **local resources** like natural landscapes, historical sites, and cultural attractions. These resources are typically accessible and readily available, requiring minimal development and marketing expenditures.

Replicating marine garbage upcycling and tourism

Pursuing tourism associated with marine waste upcycling in developing nations might be successful because it does not require a large budget or a lot of labor. First, it utilizes existing resources—namely, marine debris already collected from the ocean and shores. Thus, basic materials are already available, eliminating the need for a substantial investment in raw materials. In addition, local communities frequently operate this type of tourism, which further reduces expenses. Second, upcycling marine debris has a low capital-investment foundation. Rarely does the process require sophisticated or expensive equipment. Instead, it can be accomplished using simple equipment and instruments, indicating that the required capital investment is relatively low in comparison to other types of tourism.

Replicating ecological education for children

Although this model has more obstacles than the previous two, it is still more feasible in developing nations than other solutions that require large budgets and large numbers of people. In developing countries, access to ecological educational materials, funding, and technological infrastructure for children may be limited. Consequently, policies should take into account the availability of resources and seek to maximize the utilization of existing resources. In addition, developing nations may lack the necessary human resources and technical expertise to implement ecological education policies. Therefore, developing the capacity of educators, parents, and communities is crucial for promoting ecological education. Monitoring and assessing progress should also be included in relevant policies; it involves evaluating the effect of educational initiatives on children's environmental attitudes and behaviors and identifying areas for improvement. If these obstacles can be surmounted, ecological education can be a highly replicable solution for developing nations, requiring neither a large budget nor a large number of personnel.

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