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Climate Change Adaptation and Green Economy

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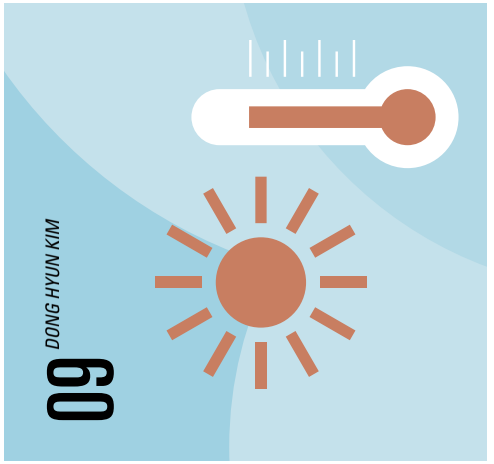

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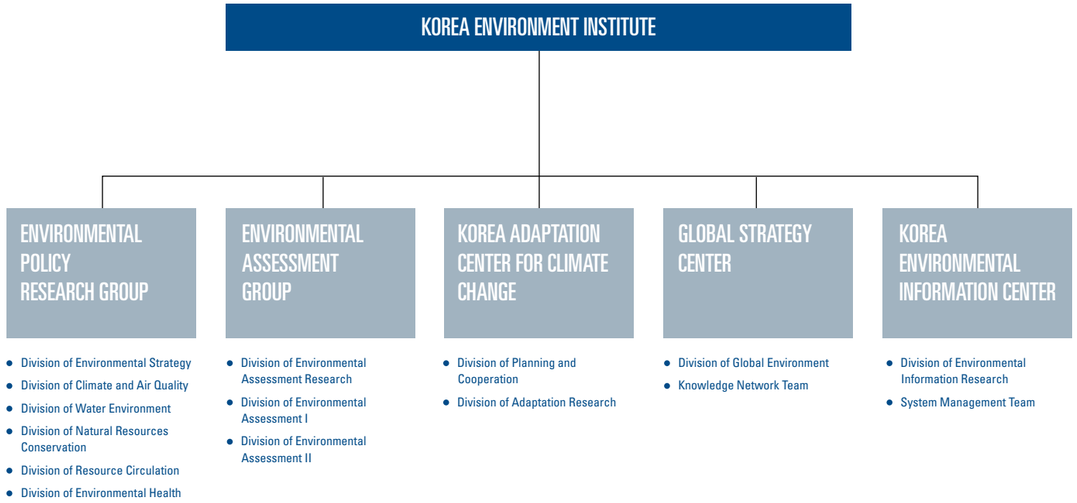

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Spatial Planning Method and Applications for Climate Change Adaptation (I)

This research has proposed a methodology that uses the recent topic of community based adaptation in climate change, and it is differentiated from any other research by highlighting the participation and communication within the planning process.

Living with weather phenomena is one of the oldest survival instincts of the human race. Before the industrial revolution, mankind generally adapted their lifestyle to natural climate in order to survive and prosper. As the society moved into industrialization, the urbanized lifestyle have resulted in the production of greenhouse gases which has led to climate change such as global warming, decreased/increased river flows, changes in the mean sea levels and increase in extreme weathers. These changes have challenged the human livelihood, and once again weather phenomena have become the focal point of discussion as one of the threats to human life. Reducing the cause of weather phenomena (mitigation) and actively preparing for the impacts of accelerating climate change (adaptation) are the efforts to take action against climate change, and these have become an important aspect in the national policies.

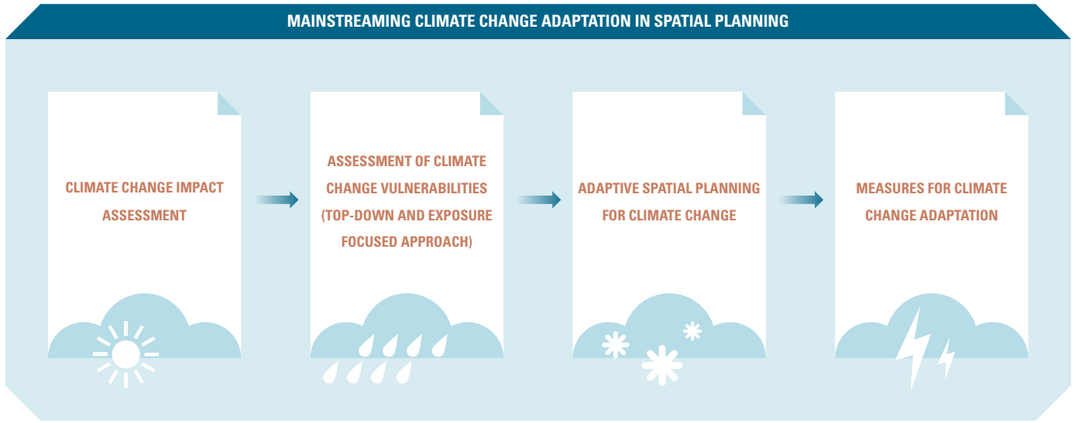
However, the efforts to proactively adapt to the possible damages of climate change is still at a basic level, and the adaptation is still not mainstreamed or incorporated within the individual policies and plans. This is mainly due to the unguided discussions on climate change adaptation in the policy and plan making process. The uncertainty of climate change itself is another contributing factor.

To overcome the limits of the existing measures, the current literature on climate change adaptation recommends place-based approach (Adger and Kelly, 1999; Turner et al., 2003; Measham et al., 2011). This means considering the characteristics and variables within the extent of a geographical area and societal and economical criteria of the place, and using them to form policies and plans. In order to enable proposal and strict implementation of the policies relating to adaptation, city as a planning unit is identified as the most suitable (Measham et al., 2011).

On this basis, the purpose of this paper is to propose spatial planning tools that would make the adaptation process practical by internalizing climate change, an external factor, within the urban planning. Initially, the most meaningful planning unit for the adaptive spatial planning was identified, and the compatibility with other spatial planning issues was reviewed. Furthermore, spatial planning elements central to the compatibility were considered in recommending a methodology that considers adaptation within the spatial planning. In this paper, strategic planning and scenario planning that are currently being considered as a way of future orientated planning were utilized. The study reviewed the utilization of the proposed spatial planning tools within the existing systems and the compliance with the standards of the decision making process and the internalizing process. Specifically, the spatial planning at community level which was often neglected in the existing planning process was considered. Finally, it explores how the local knowledge could be reflected in the spatial planning and how the local needs and collective rationality could be brought forward.

The proposed spatial planning methodology consists of three stages: developing theoretical background for the policies; establishing a framework for adaptive spatial planning; and deducing the ultimate method of adaptive spatial planning. Firstly, the policy background should go through theoretical consideration to extend the strategic planning and scenario planning to include climate change adaptation and to incorporate adaptive spatial planning definitions and characteristics. To take action against the external changes due to climate change, the future adaptation scenario for a city and a community are combined and formed, based on the future foresights. Moreover, this method is a communicative planning process based on resilience strategy.

FIGURE 1 ROLE OF ADAPTIVE SPATIAL PLANNING FOR CLIMATE CHANGE



Further discussion on a planning space implies two things – human and lifestyle. This implies practical participation from the members of the society in the planning process and approaching from the community point of view through deliberation. Hence, the spatial problems resulting from the issues faced by the society should be addressed. Therefore, it is important to gather local conditions and local knowledge in the area that represents the local lifestyle, and reflect them within the communication process.

Moving on from the theoretical background, in order to take action against the changes of the external conditions due to climate change, this paper constructs an integrated future adaptation scenario of a city and a community, based on future foresights, and proposes a communicative planning process based on a resilience strategy. Figure 1 shows the adaptive spatial planning for climate change in relation to the climate change impact assessment and the climate change vulnerabilities assessment. The climate change vulnerabilities assessment that played an important role in finding a solution for climate change adaptation would need to change from the existing index focused approach to exposure focused approach, and the areas discussed in the existing approach would need to supplement the adaptive spatial planning in accordance with the local conditions and knowledge.

To supplement the uncertainty of climate change predictions, the adaptive spatial planning for climate change includes communication and participation stages as part of the planning process. This planning process is based on communicative rationality, and it prepares for the uncertainty within the community level through foresight and governance. The adaptive

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spatial planning reduces the uncertainty, deduces the future and is used as a tool in scenario strategy. The adaptive spatial planning for climate change includes the traditional regulatory spatial planning as a tool, sets a common goal in preparation for the future, and is given a free hand to achieve consensus and co-operation. The main difference between traditional spatial planning and adaptive spatial planning is favoring the value of resilience over economic efficiency. The adaptive spatial planning includes conditional assumptions rather than focusing on excessively idealistic and unrealistic future visions. It also considers viability and co-operation, and aims to outline a feasible future through communication process. To achieve these, the adaptive spatial planning utilizes anticipatory governance, community governance and multi-level governance.

During the stage of forming a policy framework for the adaptive spatial planning, 15 of 68 existing official plans that were relevant to climate change adaptation were reviewed, and city/district master plans and lower level plans were found to be suitable for internalizing climate change adaptation. Analyzing the selected spatial plans has revealed that population and spatial structure were at the centre of the spatial planning policy, and subsequently population was divided into demography and social economy, and spatial structure into development and conservation areas. The development area is then divided further into land use, infrastructure, environment, safety and leisure, so each section would form the spatial planning framework and internalize adaptation. Under the concept of resilience, the resilience strategy approach for climate change adaptation at different levels was also discussed. The case studies of climate change adaptation spatial planning were reviewed to make the planning methodology more explicit.

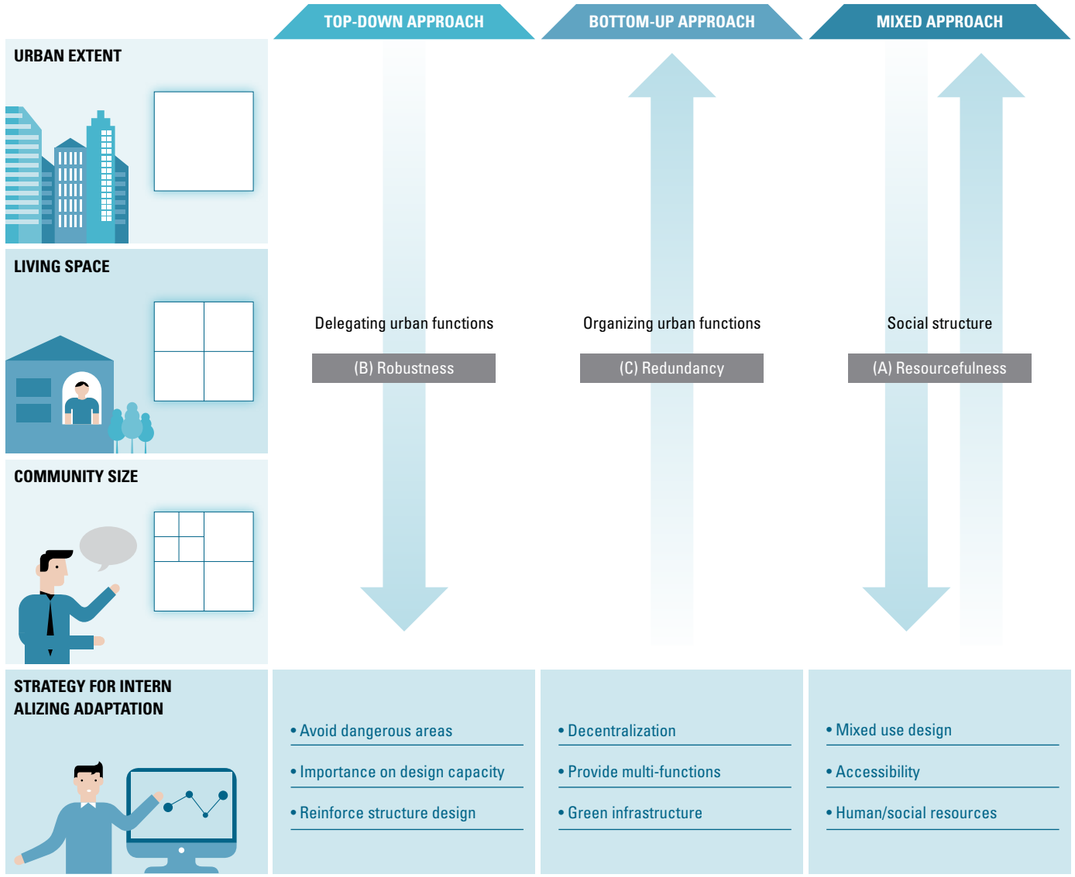
Finally, based on the aforesaid theoretical background and the policy outlines, planning sheets that could be used in adaptive spatial planning framework and specific modules were produced. Based on the theoretical background, the adaptive spatial planning methodology was created using the following five principles.

The first principle is to agree future governance based on scientific evidence. The local conditions and the scientific evidence for the climate change impacts are used to form a base, and the future plan is agreed with inputs from the public. The second principle is to form a strategic plan based on the concepts of resilience in order to integrate climate change adaptation and regional growth. The capacity of the area for climate change and the integrity of the regional economic are based on similar themes, so climate change adaptation and regional growth can be naturally integrated. The third principle is to integrate regional growth and climate change adaptation within the plan. In order to introduce climate change adaptation into the mainstream of the spatial

TABLE 1 DIFFERENCE BETWEEN TRADITIONAL SPATIAL PLANNING AND ADAPTIVE SPATIAL PLANNING FOR CLIMATE CHANGE

THEME	TRADITIONAL SPATIAL PLANNING	ADAPTIVE SPATIAL PLANNING FOR CLIMATE CHANGE
SPATIAL PLANNING STRUCTURE AND PROCESS	Structure and process based on predict and plan; Planning process based on instrumental rationality	Structure and process based on foresight, scenario and strategic plan; Planning process based on communicative rationality
SCOPE OF SPATIAL PLANNING	Urban planning, living space, community, etc all included in the scope (emphasis on different elements may differ depending on the trend of the spatial planning in each country)	Urban planning, living space, community, etc are considered but mainly focused on community planning
DIRECTION OF PLANNING	Planning based on regulations and permissions; regulatory plan to restore negative external effects of the market failure	Regulatory planning is used as a tool, but in preparing for the future a common goal is set through consent and co-operation, and a free hand is given in developing a plan
RESILIENCE, REDUNDANCY AND DECENTRALIZATION	Focused on economic efficiency for effective utilization of limited resources; Planning basic infrastructure around the population	Some redundancy created through decentralization but resilience built within the area; Preference over taking actions for the future rather than economic efficiency
SETTING DIRECTIONS FOR THE FUTURE	Planning focused on an ideal person in the future; Often unrealistic and unable to connect with various alternatives	Conditional assumptions included, and planning based on the foresight formed through deliberation on the possibilities and co-operation; Agree realistic future through consultation process
GOVERNANCE	Restricted governance, lack of experts, limited participation from the stakeholders; Associated with hierarchical and performance based process; Residents and various urban workers as passive users rather than planners or executers	Anticipatory governance; Community governance; Multi-level governance
ADAPTATION SCENARIO	Growth scenarios based on quantitative growth in terms of population, economy, industry, land use, etc	Spatial adaptation at community level

FIGURE 2 RELATIONSHIP BETWEEN CONCEPT ON RESILIENCE, PLANNING COMPONENTS & STRATEGY FOR INTERNALIZING ADAPTATION



planning, it needs to link up with the regional growth, effectively utilize the planning methodology, and encourage consensus and co-operation from the local residents. The fourth principle is to create a planning process based on communication and involvement which would increase the adaptive capacity of the community. The capacity to grow and the ability to adapt to climate change have many similar areas, and participation in the planning process brings many benefits in terms of education. Fifth principle is to come up with innovative planning alternative through discussions with the participants. Specific modules based on communicative planning process could draw out ideas from various people, and deduce innovative alternatives by processing these ideas.

Based on these principles, the adaptive spatial planning framework for climate change is divided into the following six stages:

1. Initial investigation of the area and the environment
2. Establish the context of the area and the environment
3. Set a goal for the plan (regional growth / climate change adaptation)
4. Draw up scenarios for the area and internalize adaptation strategy
5. Produce a spatial plan for the area
6. Carry out projects from the spatial plan and construct pathways

19 specific planning sheets with suggestions and requirements for spatial planning were produced for these six stages. The planning participants involved in the planning stage can use these sheets to share and learn local conditions and knowledge, and agree future plans through communication.

TABLE 2 DEVELOPMENT PRINCIPLES OF ADAPTIVE SPATIAL PLANNING METHODS FOR CLIMATE CHANGE

PRINCIPLE 1	To agree future governance based on scientific evidence
PRINCIPLE 2	To base the strategic planning on the concepts of resilience
PRINCIPLE 3	To incorporate regional growth and climate change adaptation within the plan
PRINCIPLE 4	To encourage capacity to adapt through planning process based on participation and communication
PRINCIPLE 5	To encourage innovative planning alternatives through discussions and consultation with the participants

FIGURE 3 ADAPTIVE SPATIAL PLANNING FRAMEWORK FOR CLIMATE CHANGE

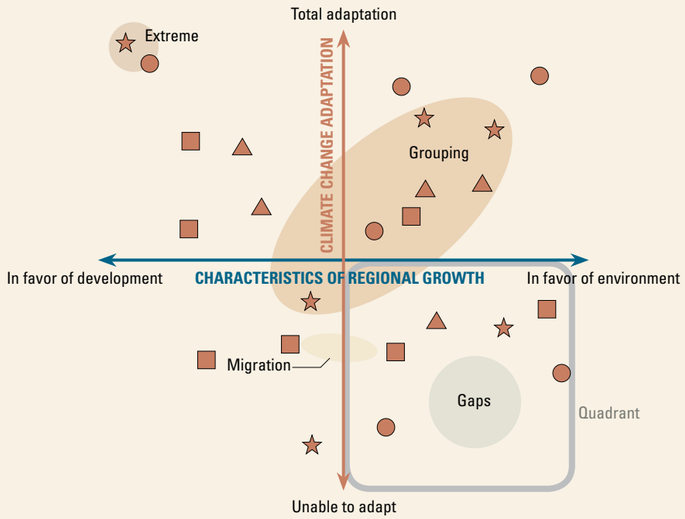
Preliminary meeting with the participants	STEP 1 Identify a location for spatial planning ↓ Identify planning group and participants group ↓ Initial investigation of the area and the environment	1 Initial investigation of existing area and conditions 2 Initial investigation of climate change issues 3 Plan and host a preliminary meeting with the participants 4 Organize participants and form a working group 5 Produce an involvement map of the area
First workshop held with the participants	STEP 2 Establish the context of the area and the environment	6 Data gathering and initial investigation of the area, and discover a common theme 7 Set planning topics and concepts to capture local context 8 Identify local needs 9 Carry out SWOT analysis to obtain local knowledge
Local residents to cast a vote	STEP 3 Set a goal for the plan (regional growth / climate change adaptation)	10 Data mining to deduce local context 11 Form essential glossary to draw plan objectives 12 Set plan objectives
Second workshop held with the participants with inputs from the experts	STEP 4 Draw up scenarios for the area and internalize adaptation strategy	13 Come up with four scenarios for the area 14 Find a solution for each scenario 15 Produce a strategy to internalize adaptation with the experts
Presentation at local galleries	STEP 5 Produce a spatial plan for the area	16 Produce an adaptive spatial plan for the area 17 Present initial findings on alternatives at public meetings and exhibit at local galleries
Third workshop with the participants	STEP 6 Projects and pathways for the area according to the spatial plan	18 Design blocks and networks for the alternative plan 19 Future plans for the area and storytelling

TABLE 3 A LIST OF PLANNING SHEETS FOR ADAPTIVE SPATIAL PLANNING METHODS FOR CLIMATE

FIGURE 4 EXAMPLES OF COMMUNICATION TOOLS INCLUDED IN THE PLANNING SHEETS

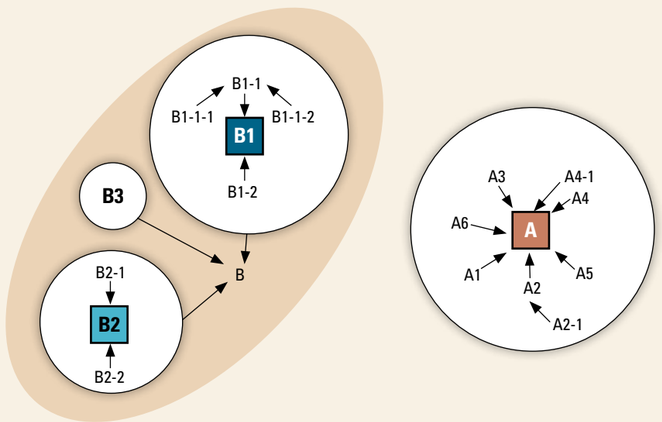
PLANNING SHEET NO. 7

Analysis methodology of deducing planning topics and concepts for the area



PLANNING SHEET NO. 10

Ways to gather local views from the residents using text mining



These planning sheets identify local planning objectives and local needs, which are then systematized to deduce a scenario and a strategy for adaptation. Design and product renovation tools such as ERAF system diagram, Entity Position Map and Grouping Matrix are adapted in the process. For the application of green infrastructure as a spatial alternative for climate change adaptation, a decision tree was created in terms of climate and spatial planning subjects.

Through the proposed spatial planning framework, the planning participants can collectively produce a final plan for the local area and construct the related projects and pathways.

The proposed adaptive spatial planning methodology for climate change can be applied to two systems, the land use/urban planning system and the environmental planning system.
For the spatial planning system, adaptive spatial planning can be introduced via two measures: one through the urban planning system; and the other through the environmental planning system. The specific details are compared below.

Introducing through the urban planning system has advantages of considering the suitability and the implementation of amending the existing plans. However, the implementation can become a low priority and insufficient consideration of climate change can be the disadvantages. In terms of the environmental planning system, the adaptive spatial planning can be combined with other elements of the environmental planning so the changes to the guidelines and the procedures can be easier. However, there is the inconvenience of revisiting the elements relevant to the regional growth, and its implementation cannot be guaranteed.
Another way of implementing the deduced plan in the existing system is to use the neighborhood planning and

FIGURE 5 A DECISION TREE FOR GREEN INFRASTRUCTURE IN ADAPTIVE SPATIAL PLANNING FOR CLIMATE CHANGE

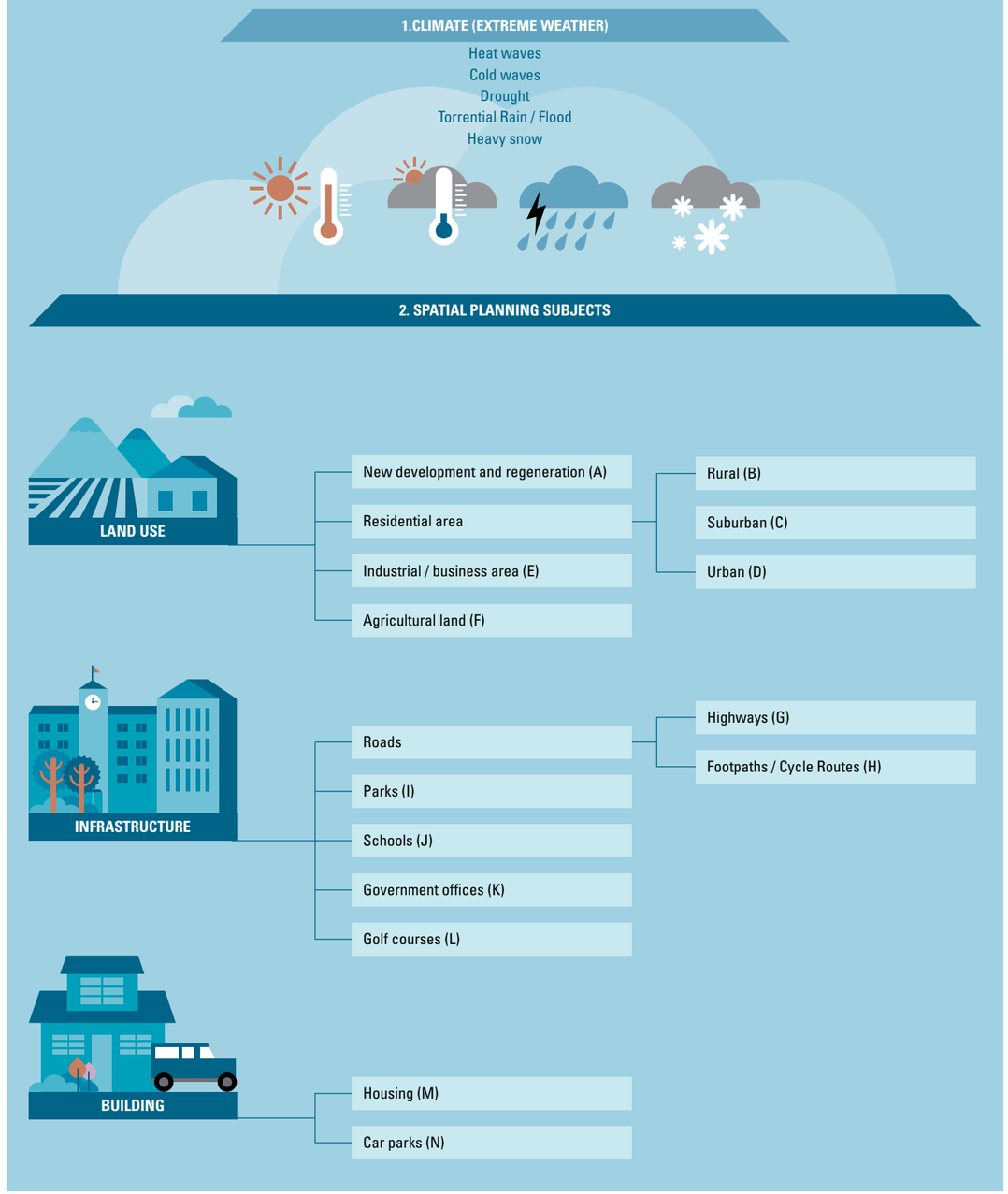
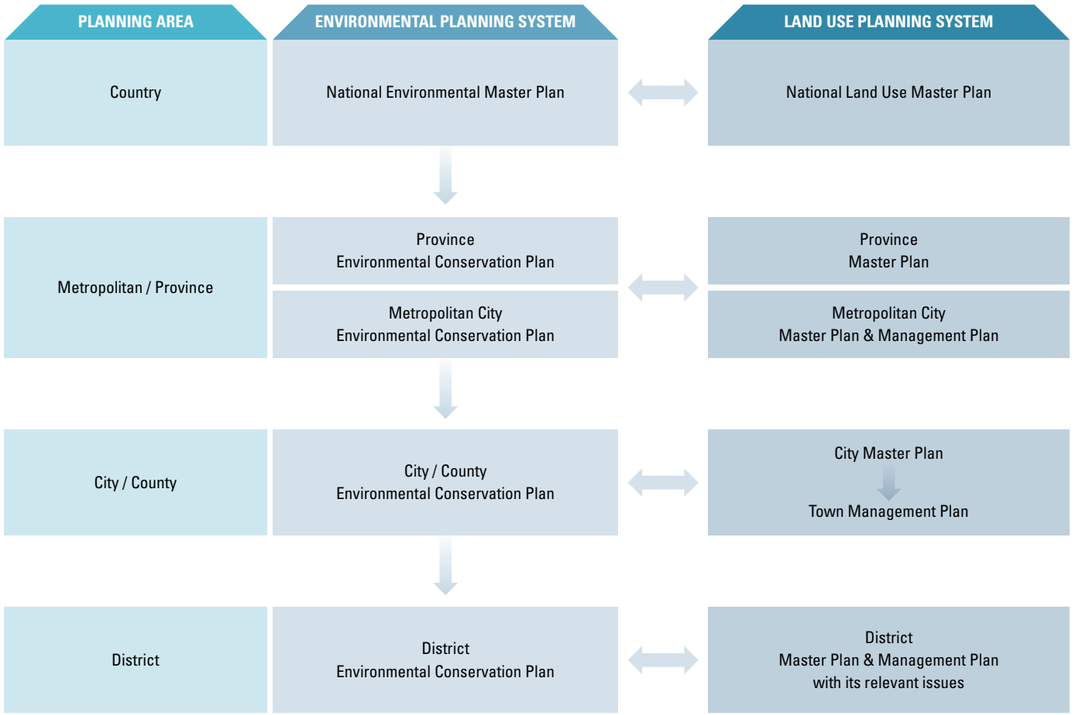


FIGURE 6 RELATIONSHIP BETWEEN ENVIRONMENTAL PLANNING AND LAND USE PLANNING SYSTEMS



Ministry of Environment (2007).

the community participation system. Generally, the neighborhood planning, which includes suggestions from the community, is focused on the regional growth and the environmental improvements. The adaptive spatial planning also has regional growth as one of its values, so for the effective implementation a sufficient communication process with the local residents is needed to combine the contents of regional growth and climate change adaptation. In the community participation system, it can be used for running the climate change adaptation planning process or prioritizing the specific projects from the plan.

The proposed adaptive spatial planning methodology for climate change can be used by the local groups to find ways to adapt and operate the spatial plans. The proposed methodology is not a unified implementation plan, but a method to achieve both regional growth and climate change adaptation in the local management area. It will reflect the appropriate local needs and become a way to deduce spatial planning that considers adaptation scenario.

This research has proposed a methodology that uses the recent hot topic of climate change adaptation in real planning terms, and it is differentiated from any other research by highlighting the participation and communication process within the planning stage. Through this research, the scenario planning and the strategic planning methods are combined, and climate change adaptation and the concepts of resilience are mainstreamed. Furthermore, methodologies used in design and product renovation process are applied in the spatial planning to identify creative planning alternatives. Through this participation and communication process within the planning stage, an increase in the local capacity to adapt to climate change and mainstreaming climate change adaptation are anticipated.

TABLE 4 MEASURES TO INSTITUTIONALIZE ADAPTIVE SPATIAL PLANNING FOR CLIMATE CHANGE

ELEMENTS	MEASURE 1 (Introduce within the urban planning system)	MEASURE 2 (Introduce within the environmental conservation planning system)
PLANNING AREA	Internalizing adaptation within: whole planning area and living space (city / county master and management plan) & regional planning area Adaptive spatial planning within: neighborhood planning area (community)	Internalizing adaptation: as part of the relevant spatial planning section of the city/county/ district environmental conservation plan; Adaptive spatial planning: as part of the relevant spatial planning section of the city/county/ council environmental conservation plan (regional planning area and space units should be subdivided to adjust)
GUIDELINE FORMATION	Maintain high level plans for the city/county and append a separate guideline	Planning guidelines to clearly state which sections of the environmental conservation plan should incorporate adaptive spatial planning for climate change, and the applicable clauses should be included within the guidance as a separate chapter.
SUITABILITY WITH OTHER PLANS	Priority given over suitability with regional development and growth plans (including infrastructure and use area, etc)	Priority given over suitability with weather and climate issues
PRACTICALITY IN ESTABLISHING AND ADAPTING THE PLAN	Likely to be suggested as one of the methods to design a low carbon green city and be established and applied in the process (unregulated case)	Unless it becomes a statutory requirement, it will be difficult to apply, and it would need to be reviewed at the same time as other items such as environmental impact assessment (regulated case)
INTRODUCING METHODS	Establish detailed guidelines in accordance with the city/district master plan guidance Chapter 7 item 5-7-2-(5), and join up with the lower level city/district management plans and regional plans	Revise entire guidelines in the local environmental conservation plans
ADVANTAGES	Adaptation can be internalized within the sections of land, urban area, regions, etc according to land use and urban planning systems; Build ways to aid understanding within the existing planning system; Use residential environment improvement activities in regional planning.	Can be discussed with other environmental conservation issues; Easy to establish plans through new main agents; Straightforward amendments to guidelines in line with other areas.
DISADVANTAGES	The plan for climate change adaptation may not be detailed; Clauses for climate change adaptation can become a low priority if not in line with the regional growth clauses; Lack of comprehensive discussion due to many procedures and items required during the plan development stage.	Difficult to directly reflect regional growth and other urban planning issues; Difficult to guarantee the execution of the established plan; Would need to agree and revise the entire guidelines (plan titles would need to be changed).

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Agricultural Sectors in Laos and Cambodia

Laos and Cambodia conform to the industrial structure of traditional agriculture-centered countries. The national strategies of these countries also center upon agricultural and rural development and environmental issues, including food security, poverty eradication, and climate change.

As an important means to achieve sustainable development and address the poverty issue in developing countries, the green economy is now presented as a new direction for all mankind. In particular, emphasis is placed on the fact that sustainable agriculture must take priority in order to respond to the growth in global population and the subsequent rise in the demand for food. With a focus on eradicating poverty, enhancing social equity and minimizing factors harmful to the environment in Laos and Cambodia, which are countries prioritized by Korea for cooperative efforts, this study aims to discuss strategies for expanding the green economy in agriculture as the main driver of the economy in these countries, and suggest policy proposals from the perspective of international cooperation.

Laos and Cambodia conform to the industrial structure of traditional agriculture-centered countries, with the agricultural sector accounting for more than 30 percent of the entire GDP and over 70 percent of the national workforce engaged in the agricultural industry. This indicates that the development of rural areas is necessary not only to exterminate absolute poverty, but also to enable continued economic development. The national strategies of these countries also center upon agricultural and rural development and environmental issues, including food security, poverty eradication, and climate change.

In Laos, slash-and-burn agriculture has been identified as a major cause of deforestation and poverty, due to its prevalence in mountainous areas that comprise about 80 percent of the entire land. The Lao government attempted to address this issue by banning the controversial agricultural technique in the 1980s, but this move has instead resulted in spreading the destructive slash-and-burn practice, the main advantage of which is the short fallow period. This situation is driven not only by internal factors such as the growing population in the mountainous areas and lack of technology for paddy rice farming available to farmers, but also by external factors such as large-scale infrastructure development projects, expansion of industrial forestation projects, the Lao government's policy to relocate or merge villages, and the Land and Forest Allocation program. This resulted in the destruction of forests in total contrast to the original objective, as well as reduced household income caused by the decreasing productivity corresponding to the deteriorating quality of soil.

In addition, the cultivation of cash crops are rapidly expanding in the mountainous areas of Laos as a combined result of the abovementioned policy and the increasing demand for agricultural products in Vietnam and other neighboring countries, but concerns have been raised over income instability among the local residents and the food crisis possibly caused by unfavorable contracts and price volatility in the international markets.

Conditions in Cambodia are largely suitable for agriculture, with a favorable climate, abundant manpower and water resources, and the government is pursuing agricultural policy as a major strategy in fighting poverty. Under the policy direction, the area of agricultural production is expanded every year with the core objective of exporting rice and meeting demands from the agricultural industry, while a range of support measures is provided to encourage public and private investment in agriculture and to strengthen technical capabilities of farmers through research on agricultural technology and the agricultural extension service. In addition, expanded technical and financial support from aid-giving

FIGURE 1. PICTURES OF SLASH-AND-BURN AGRICULTURE OF LAOS

Source: Vanthong Phengvichith, 2009

30% The agricultural sector accounts for more than 30 percent of the entire GDP

70% Over 70 percent of the national workforce accounts in the agricultural industry

80% Mountainous areas comprise about 80 percent of the land in Laos

TABLE 1. SWOT ANALYSIS OF AGRICULTURE IN MOUNTAINOUS AREAS OF LAOS

STRENGTHS	WEAKNESSES
• Sense of community and resident participation system • Growing cultivation of cash crops and increasing number of stockbreeding farms	• Lack of agricultural technologies for paddy-field farming • Poor state and inefficient management of agriculture-related infrastructure (roads, irrigation facilities, machinery and tools) • Labor-intensive farming with low productivity
OPPORTUNITIES	**THREATS**
• Growing importance of sustainable agricultural development within the international community through the Rio+20 Conference, etc • Government policy to encourage commercial farming in mountainous areas, including micro-financing, land distribution with resident participation, and introduction of technologies requested by farmers • Increased demand for agricultural and livestock products and abundant opportunities to exploit new markets, following economic growth and urbanization of neighboring countries including China and Vietnam	• Land degradation and increasing forest destruction due to the shortened fallow period caused by the ban on slash-and-burn farming • Unstable resident income due to the volatility of national prices on cash crops • Threatened food security • Environmental pollution caused by increasing use of agricultural chemicals

FIGURE 2. CROP PRODUCTION AREAS IN CAMBODIA

Source: USAID (2010b).

institutions is a favorable factor for the development of agriculture and rural areas in Cambodia.

Despite the continued expansion of irrigation facilities through government policy support, inadequate capacity for facility management has led to a low rate of rice production compared to the amount of water supplied, and subsequently the low collection rate of water usage fees for irrigation facilities creates further difficulties for facility management. The lack of infrastructure for milling and storage facilities is also an obstacle to ensuring price competitiveness for rice and enhancing agricultural household income. Risks to sustainable agricultural development include environmental contamination, such as water pollution caused by the increased use of agricultural pesticides and fertilizers during the dry season for higher crop yields and the intrusion of saltwater into groundwater reserves due to excessive abstraction of groundwater for irrigation and energy uses.

As the hydroponic agricultural system of Cambodia usually uses the sewage or wastewater flowing into wetlands in suburban areas, this enables the biological treatment of wastewater and cheap, large-scale output by water plants. Hydroponic vegetables are consumed on a near-daily basis by the Cambodian people, contributing to the high market demand, and therefore are known as an excellent source of income compared to other income sources in rural and urban areas. The recent increase in reclaimed wetlands driven by expanding urbanization and industrialization is raising concerns over greater water pollution and the resulting health and hygiene damages that may be caused by hydroponic agricultural products. Sewage and factory wastewater is often discharged into wetlands or artificial ponds made for wastewater treatment without undergoing proper treatment, and water quality is deteriorating due to the use of agricultural pesticides and chemical fertilizers by farmers unaware of potential consequences, along with mining activities and subpar urban sewage management. In an effort to protect the environment of water resources, the Ministry of Environment of Cambodia selects regions that supply water for public use, monitoring and managing the quality of public water each month, while the Ministry of Water Resources and Meteorology collects and analyzes water samples on a monthly basis. However, the

TABLE 2. SWOT ANALYSIS OF IRRIGATION AGRICULTURE IN CAMBODIA

STRENGTHS	WEAKNESSES
• Favorable climate and abundant water resources for multiple cropping. • Annually increasing arable area to meet the demand from the agricultural industry. • Stable implementation of policy and rapid economic growth following the stabilization of domestic politics following the 2013 general elections.	• Insufficient capability for postharvest handling and management, e.g. poor infrastructure for pounding and storage facilities. • Insufficient capability to manage irrigation facilities. • Inefficient rice productivity compared to the supply of water.
OPPORTUNITIES	**THREATS**
• Strong government will to foster agriculture and the rice industry through national strategies including the Rectangular Strategy. • High level of openness to external markets and a large volume of ODA received from the international community (including South Korea). • Increasing opportunities for agricultural exports to neighboring countries.	• Low income level among residents in rural areas. • Decreased payment rate for water use fees. • Increasing use of chemical fertilizers following the permission for private operators to import chemical fertilizers. • Concerns over the depletion of groundwater and water pollution.

FIGURE 3. INLETS AND OUTLETS AND MAIN WATER SPINACH GROWING AREAS OF THE BOEUNG CHEUNG EK LAKE

Source: Kuong K. et al. (2007)

TABLE 3. SWOT ANALYSIS OF HYDROPONIC AGRICULTURE IN SUBURBAN AREAS IN CAMBODIA

STRENGTHS	WEAKNESSES
• Large-scale natural wetlands in Phnom Penh • Low labor cost and simple technology compared to other cultivation methods • Increased agricultural output and effect of self-purification of water quality based on the use of urban sewage and wastewater as a main source of fertilizers	• Lack of technology to commercialize hydroponic products • Reduction of output and income due to floods or other natural disasters • Insufficient national strategies and public awareness for the conservation of aquatic environment
OPPORTUNITIES	**THREATS**
• Increasing demand and marketability of hydroponic agricultural products • Direct and indirect increase in income among farmers and middle traders in wholesale and retail, due to possibility of year-round cultivation • A priority recipient for credit assistance and grant-type aid from Korea, with agriculture being the priority sector for cooperation	• Increasing reclamation of wetlands following urban development • Livelihood threatened by the decreasing area for hydroponic cultivation • Forced eviction of the poor • Worsening water pollution due to increased use of agricultural pesticides and shrinking area of wetlands • Reduced economic value of hydroponic vegetables and rising concern over health and hygiene due to increasing water pollution

effectiveness of such endeavor remains limited, largely due to the lack of a national strategy, shortage of expert manpower, and the fiscal crunch.

The reclamation of lakes to expand the urban area has resulted in the forced eviction of low-income residents and decrease in the area of land used for hydroponic cultivation, thereby posing a threat to the livelihood of farmers and increasing the number of the urban poor. In response to the situation, some farmers have learned advanced hydroponic techniques from neighboring countries to establish facilities for artificial hydroponic agriculture and cultivate high-quality hydroponic crops. However, such cases are extremely rare, and most ordinary farmers do not possess the necessary level of technical knowhow and cannot even make such an attempt due to the financial burden. Against this backdrop, the main areas for international development cooperation to help sustainable development of agriculture and rural areas in Laos and Cambodia in consideration of the green economy are as follows.

For the slash-and-burn agriculture in the mountainous areas in Laos, the introduction of high added-value agricultural management suitable for the climate and soil of the mountainous areas is necessary in order to protect forestry resources and prevent soil deterioration caused by crop cultivation, and as a replacement for the slash-and-burn method, which is on the rise following the government ban. As part of the countermeasures, this study proposes an international cooperation project designed to distribute technology of breed improvement, in order to facilitate region-rotational and eco-friendly livestock industry in accordance with national strategies. Except for the plains around the Mekong River basin, most crops in Laos are cultivated during the wet season due to the insufficient irrigation facilities. Particularly in the mountainous areas occupied for slash-and-burn farming, irrigation facilities are inadequate for the small minority share of paddy rice farming. The restructuring of irrigation will facilitate not only rice farming, but also greater stability in the cultivation of many other crops, contributing to the improvement of diet and income among Lao residents. Under the current agricultural conditions in Laos, it is necessary to establish eco-friendly irrigation facilities with high field adaptability that may be managed by the tightly knit local communities of Laos, instead of facilities such as pumping stations and tube wells that require large installation costs as well as significant costs and efforts for maintenance.

A primary concern for irrigation agriculture in Cambodia is improving rice productivity in rainfed paddy fields during the wet season, and it will be more desirable to enhance management efficiency than to increase the irrigation ratio by undertaking medium- or large-scale projects for water resources development that will require investments and incur environmental impacts to a significant degree. Secondly, productivity must be improved by enhancing technical efficiency from developing high-yielding seeds for example, and it is particularly imperative to develop varieties that deter the use of a large quantity of farm inputs such as chemical fertilizers and agricultural pesticides. Thirdly, instead of extending the rice-farming area to hilly areas where obtaining a supply of water resources is difficult, it is worth considering the reduction of excessive dependence on rice farming in such regions and instead discovering and distributing alternative crops for higher income generation and commercialization.

Due to the rapid urban development in Phnom Penh, and the resulting industrialization and the reclamation of natural wetlands, concerns have been constantly raised over the possibility of reduced areas for hydroponic cultivation, which is the main source of income for the poor strata in the suburban areas, and deteriorating water pollution, thus posing a threat to the livelihood of the poor and public health and hygiene. In response to these problems, it is necessary for the government to provide financial support for the early settlement and vitalization of eco-friendly artificial hydroponic agriculture, which will enable the large-scale production of clean and high-quality vegetables all year round regardless of harvest conditions, as well as clean cultivation environment to reduce unfavorable conditions for labor practices. In addition, farmers must be given appropriate support to enhance their capabilities in terms of technical skills. In order to prevent water pollution, one of the major environmental challenges caused by urbanization, it is urgent to establish basic environmental facilities for the treatment of sewage and wastewater, and disposal of waste, and to systemically restructure relevant policy and legislation.

The area of international cooperation proposed in this study is where Korea has a comparative advantage in terms of agricultural experience and technology, and the area coincides with the sectors included in the National Strategic Development Plan (NSDP) of Laos and Cambodia. Furthermore, it is advisable for the two countries, which are designated as priority countries for official development aid (ODA) provided by Korea, to pursue systemic development and cooperation projects based on a strengthened multilateral cooperative system requiring joint participation by the private sector, government and other aid-providing institutions.

Keywords : Sustainable development, green economy, slash-and-burn agriculture, irrigation agriculture, hydroponic agriculture

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Dong Hyun Kim, 2014, Civil Participation and Policy Solution for Urban Disaster Management. Journal of Korea Society of Hazard Mitigation 14(5)
Dong Hyun Kim, Hye Jeong Seo, Byung Kook Lee, 2014, Method of Green Infrastructure Application for Sustainable Land Use of Non-urban Area: The Case Study of Eco-delta City. Journal of Korea Society Environment Engineering 36(6)
Dong Hyun Kim, Hee-Sun Choi, 2013, The Planning Process and Simulation for Low Impact Development in Waterfront Area, Journal of the Environmental Policy 12(1)
Dong Hyun Kim, Ye Seul Choi, and Up Lim, 2012, An Analysis of Labor Mobility using Hierarchical Generalized Linear Model: Individual and Regional Factors, Journal of the KRSA 28(3)

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Transfer and diffusion of appropriate technology for securing safe drinking water in developing countries(II)-Membrane distillation using solar energy, 2013.
2012 Modularization of Korea's development experience: Small-scale waterworks and sewerage systems, 2013d

Profiles of KEI Researchers

Executives

Name	Position	Main Research Area
Park, Kwang Kook	President	
Lee, Byung Kook	Vice President	Water Environment Management, Water Supply and Sewage Engineering, Life Cycle Assessment
Lee, Young Soo	Head, Office of Planning and Coordination	Air Quality Management, Environmental Impact Assessment, Health Impact Assessment
Lee, Changhoon	Director General, Environmental Policy Research Group	Environmental Economics
Lee, Young-Joon	Director General, Environmental Assessment Group	Geology, Environmental Impact Assessment
Song, Young-IL	Director General, Korea Adaptation Center for Climate Change	Environmental Assessment, Water Quality Management
Ro, Tae Ho	Director General, Global Strategy Center	Ecology, Environmental Impact Assessment, International Cooperation
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Environmental Policy Research Group

Director General: Lee, Changhoon (Senior Research Fellow)

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Chang, Ki-Bok	Chief Research Fellow	Chief Research Fellow
Kang, Sung Won	Senior Research Fellow	Econometrics, Fiscal Policy, CGE Model
Kim, Jong Ho	Senior Research Fellow	Environmental Economics
Ahn, SoEun	Senior Research Fellow	Natural Resource Economics, Environmental Valuation
Chung, Woo Hyun	Research Fellow	Environmental Policy, Policy Analysis
Kwak, So Yoon	Research Fellow	Economics, Value Estimation
Lee, Misuk	Research Fellow	Techno-economics, Consumer Demand Analysis, Economic Analysis
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Lee, Sangbum	Senior Research Fellow	Landscape Ecology, RS/GIS, Environmental Impact Assessment
Kim, Tae yun	Research Fellow	Water Quality Modeling, Hydro-dynamic Modeling, Environmental Impact Assessment
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Korea Adaptation Center for Climate Change

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DIVISION OF PLANNING AND COOPERATON

Name	Position	Main Research Area
Park, Chang Sug	Director	Environmental Planning & Design
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DIVISION OF ADAPTATION RESEARCH

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Global Strategy Center

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Kang, Taek Goo	Research Fellow	International Relations, Chinese Environmental Policy
Kim, Ho Seok	Research Fellow	Energy Economics, Environmental Economics
Shim, Changsub	Research Fellow	Climate Change Monitoring, Air Quality Assessment and Modeling
Jung, Jae Hyun	Research Specialist	Environmental Engineering

KNOWLEDGE NETWORK TEAM

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Park, Jun Hyun	Researcher	Public Policy, Development Policy

Korea Environmental Information Center

Director General : Jeon, Seong Woo (Chief Research Fellow)

DIVISION OF ENVIONMENTAL INFORMATION RESEARCH

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Jeon, Seong Woo	DIrector	Environmental Planning, Natural Environmental Policy, Environmental Intelligence Management System
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Key Research 2014

THEME	RESEARCH PROJECT
BUSINESS-FRIENDLY ENVIRONMENTAL POLICIES AND STRATEGIES	1. Big Data Analysis on Demand for Environmental Policy
	2. Study on Win-win Methods Between Large and Small Enterprises to Reinforce Global Competitiveness of Recycling Industry of Waste Metal Resources
	3. The Development of Criteria and Indicators for Environmental Welfare.
	4. Review of ICT Solutions for Green Lifestyles
	5. A Study of Organizing Legal System for Resource-circulating Society
	6. Management and Sustainability of Hyporheic Zones
PROACTIVE AND FUTURE-ORIENTED ENVIRONMENTAL MANAGEMENT FRAMEWORK	1. Asset Management of Water Infrastructure to Improve the Water Environment Service of Urban River
	2. A Study on Establishment of Chemical Action Plan for Enhanced Utilization of Risk Assessment in Policy Making (II)
	3. Evaluation of Air Emission Reduction And Technology Development Caused by ELV Reinforcement
	4. Assessment of Chronic Health Effects of Air Pollution from Cohort Study
	5. The Roles and Responsibilities of Land Owner or Occupiers to Effectively Manage Nonpoint Source Pollution
	6. Development of a policy and management framework for freshwater harmful algal blooms
	7. A Study on Establishment and Management of Sustainable Financing System for Water and Sanitation (II)
LIFE-CYCLE ENVIRONMENTAL ASSESSMENT FOR SUSTAINABLE DEVELOPMENT	1. Effective Application of Strategic Environmental Assessment (II): Practical Guidelines for the Assessment of Policy Plans
	2. A Study on Management Plan for Conflict Mitigation of Apartment Noise
	3. LID Implementation Scheme for Environmental Impact Assessment
INTERNATIONAL COOPERATION FOR CLIMATE CHANGE ADAPTATION	1. Spatial Planning Method and Applications for Climate Change Adaptation (II)
	2. A Study on Establishment of Long-term Heat wave Plan Addressing Climate Change
	3. Analysis of Socioeconomic Impacts of Climate Change based on Indicator Approach
GLOBAL KNOWLEDGE-SHARING ON ENVIRONMENTAL ISSUES	1. Regional Cooperation on Environmental Disaster Countermeasures in Northeast Asia
	2. Study on Korea's ODA strategy for Human Rights to Water in SDGs
	3. The Impact of the National Plan for Future Electric Supply on Ambient Air Quality of Korea

Key Research 2015

TITLES	LEAD RESEARCHER
1. Inconvenience Costs and Policy Implications of Environmentally Friendly Actions	Lee, Misuk
2. A Phased Response Plan for Inflow of Air Pollution Sources Across the Borders	Lee, Sang Yun
3. Policy Development for Changes in Water Demands such as Ecological Flow and Water Features	Kim, Hojeong
4. Policy Planning for Local Environmental Health Infrastructure – Korean CARE Program	Bae, Hyun Joo / Shin, Yong Seung
5. Plans to Expand Ecological Conservation Areas	Lee, Soo Jae
6. Analysis of Waste and Debris Cycle to Enhance Resource Circulation of End-of-Life Vehicles	Lee, Hi Sun
7. Alternative Assessment and Set Up during Environmental Assessment	Lee, Sangbum
8. Local Resource Management in Light of Climate Change Adaptation	Lee, Jeongho
9. Response to Environmental Impacts and Joint Environmental and Economical Cooperation Strategy in North East Asia FTA	Chu, Jang Min
10. Gathering and Using Environmental Data of North Korea (I) - Building up Land Covering Map	Jeon, Seong Woo
11. Improvements to Management System for Below Ground Environment (I)	Hwang, Sang Il
12. Development and Application of Indicators of Base Run-Off for the Management of Groundwater Reliant Ecological System	Kang, Hyeongsik / Hyun, Yunjung
13. Development of Combined Land Use Model for Climate Change Adaptation Strategy	Kim, Oh Seok
14. Spatial Planning Assessment System and Model Development for Building Resilience in Urban Climate	Kim, Dong Hyun
15. Alternative System in Preparation of Failure of Environmental Infrastructure due to Climate Change	Ryu, Jae Na
16. Developing a System of Impact Assessment for Chemical Accidents	Park, Jeong Gue / Suh, Yang-Won
17. Predicting Ecological Network Changes Using Random Week (I)	Kim, Ji Young
18. Noise Assessment and Management Plan for Wind Farms	Park, Young Min
19. Bridging Livable City Development over Local Climate Smart Development under UN SDGs	Chang, Hoon
20. Improving Acceptability of Unwelcome Public Facilities through Government 3.0 Paradigm Selecting Locations for High Level Radioactive Waste Treatment Plants	Kim, Tae Hyun