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A review of climate change adaptation policies applied to landscape planning and design in Korea

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Abstract This paper reviews how recent climate change policies in Korea have affected practices in landscape planning and design. By illuminating the gaps between government policies on climate change and actual practices in planning and design, the study aims to provide useful directions for future research and practices. The primary problems we found are as follows: (1) the government's recent aggressive climate change policies have partly resulted in an adverse effect on the environment; (2) planning and design tools to implement climate change policies do not tend to consider local characteristics and different biophysical and sociocultural contexts; (3) climate change policies in Korea developed by different governmental departments are not coordinated well enough to effectively meet the policy goals; and (4) design tools or guidelines intended to aid the implementation of climate change policies at site level must be improved through the use of creative ideas and empirical tests. For future research, we recommend hunting for critical evidence as to why climate change policies are not implemented effectively in a particular local context, and determining how such failures can be overcome by applying adequate measures in planning and design.

Keywords Climate change policy · Landscape planning · Landscape design

Introduction

The issue of climate change is increasingly affecting governmental policies across the world, leading to a variety of modifications to landscape design and planning practices. With the growing recognition of the problems and threats posed by global climate change, such as an increasing rate of natural disasters, the Korean government established a National Comprehensive Plan for Climate Change Adaptation in 1999. Updates to this national plan and subsequent new strategies such as the National Adaptation Strategy and Framework Act on Low Carbon, Green Growth have incorporated proactive strategies to tackle the challenges associated with climate change, promoting cooperation with and participation by local governments (Jo et al. 2009). Based on this national plan, the central government and local governments have adopted new policies not only for managing air, water, waste, and natural resources but also relating to energy, architecture, urban planning and landscape architecture, and construction. Some of the policies that are now being applied in energy, water resource management, and urban planning are directly related to practices used in design and planning at site level. A notable national energy policy is Energy Vision 2030, an ambitious governmental plan launched in November 2006 to reduce energy use by 46 % between 2007 and 2030. The plan aims at energy security, energy efficiency, and environmental friendliness, and establishes a target that 11 % of the energy production portfolio should derive from renewable sources by 2030, with all households expected to have access to affordable energy. Recent policy interventions to respond to climate change are also notable in the areas of urban planning and associated resource management, especially considering recent urban natural disasters such as the Woo-myun mountain landslide in 2011 (which killed 16 people) and the unprecedented flooding events in the capital city of Seoul in 2010 (Kang et al. 2011). The creation and application of new policies to respond to climate change problems has been pursued by a

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variety of governmental departments, but implementations of those policies do not appear to have achieved their intended outcomes so far, in contrast to what has been observed in other countries (Helm 2008; Oliveira 2009; Hwang and Chang 2010). With respect to policy goals and direction, Helm (2008) asserted that international and national policy responses to climate change have thus far had little impact on the build-up of emissions, due largely to unreliable global targets for climate mitigation and adaptation but also because energy demands and carbon emissions are rising faster than population growth. Oliveira (2009) argued that the failure to implement climate change policy is mainly due to a lack of integration with other policies, a failure to integrate different levels of government to deal with climate change, and the unsuccessful integration of civil society groups into the policy process. Innovative climate change policies have also often failed to translate knowledge of the climate into guidelines for landscape design and planning (Alcoforado et al. 2009).

This paper provides a broad review of how recent climate change policies in Korea have affected practices in landscape planning and design. By illuminating the critical gaps between government policies on climate change and actual practices employed in planning and design, the study aims to provide useful directions for future research and practices.

Korean policies developed in response to the issue of climate change

Korea has a wide range of regulatory requirements that are related to climate change mitigation and adaptation. Following the Global Financial Crisis in 2008, Korea's stimulus package was widely seen as the "greenest," with up to 69 % of the spending directed into "green projects" such as renewable energy, energy efficiency, and a smart grid. In line with these projects, major laws regarding climate change mitigation and adaptation were established in 2010. The first law was the Framework Act on Low Carbon Green Growth[1] of 2010, which was enacted to provide a legislative framework for mid- and long-term emission reduction targets, cap and trade, carbon tax, carbon labeling, carbon disclosure, and the expansion of new and renewable energy. In the same year, The Enforcement Decree of the Framework Act on Low Carbon, Green Growth was created to monitor the operation of the Presidential Committee on Green Growth and to establish and support green industry investment companies, as well as to control the quality of greenhouse gas emissions (GHGs) and the quantity of energy consumed in each area, including by transport and architecture. In 2012, the Act on the Allocation and Trade of Greenhouse Gas Emissions Rights established trading schemes for companies that emit 125,000 metric tons or more of carbon dioxide a year and factories, buildings, and livestock farms that produce at least 25,000 tons of the gas annually. The Act on the Creation and Facilitation of Use of Smart Grids of 2011 is a 5-year plan to create smart grids and facilitate green growth in order to effectively respond to climate change. These new laws focusing on energy and GHG reduction provide important foundations for a variety of governmental departments to establish new climate change policies across a wide range of areas.

Landscape planning approaches to climate change problems

Here, "landscape planning" is broadly defined as planning that affects land-use decisions. It encompasses primary institutional plans across spatial and temporal scales, including national, regional, and local comprehensive land-use plans, strategic land-use plans, and environmental impact assessments (EIAs). A notable policy change in land-use planning is the creation and provision of The Guideline for Low-Carbon City Planning in 2009 by the central government. This guideline is intended for use at all levels of planning. Its aim is to minimize GHG (including carbon dioxide) through the application of a variety of measures relating to zoning, transportation, waste treatment, and natural resource management. National, regional, and local land-use plans have been significantly affected by Energy Vision 2030. Due to aggressive governmental support, a variety of land-use plans for renewable energy development plants have been proposed over the last 5 years. However, these plans have encountered problems due to the fact that the construction of renewable energy sources such as wind farm plants, solar panels, and tidal power plants tends to be accompanied by the irreversible destruction of forest, wetland, and tideland ecosystems (Choi 2011) (Figs. 1, 2). Among these, the Garolim tidal power plant has been the most contentious issue between the government and environmental experts

[1] "Green growth" first emerged as an alternative path that goes beyond the sustainable development rhetoric at the Fifth Ministerial Conference on Environment and Development (MCED) held in 2005 in Seoul (UNESCAP 2008). The green growth approach seeks to harmonize economic growth with environmental sustainability, while improving the eco-efficiency of economic growth. Green growth strategies aim to guide the process of mainstreaming climate resilience and low carbon development into key sectors of the economy (UNSDKP 2014). In 2008, partly in response to the Global Financial Crisis, Korea adopted Low Carbon, Green Growth as the country's new development vision, which was followed by the release in 2009 of the National Strategy for Green Growth and 5-Year Plan for Green Growth (accompanied by the enactment of the Framework Act on Low Carbon Green Growth).

Fig. 1 An example of landscape destruction due to the construction of a wind farm in Korea (photo from http://www.egreeneconomy.com/news)

because of its potentially destructive impact on the vast tideland of the west coast (Fig. 3) (Lee and Yoo 2009). While several wind farms and solar power plants have been established despite concerns about environmental destruction, some plans have been canceled or dropped as a result of strong opposition from environmental groups or NGOs.

The strategic planning that local governments must perform every 5 years has also been affected by the new climate change policies. In 2012, the central government required local governments to establish hazard mitigation plans to effectively respond to climate change and to reflect those plans in strategic land-use plans. This has led to a more aggressive EIA process when assessing local strategic plans for vulnerability to a variety of natural disasters (Yi and Hacking 2011). However, less than a half of all local municipalities have actually established hazard mitigation plans, and the plans that have been drawn up are not adequately reflected in local strategic plans. This can be attributed to a lack of guidelines on how to actually incorporate the two types of plans.

The ecological area ratio (EAR)—established by the Ministry of Environment in 2005 to ensure that a certain proportion of the area covered by a new development is permeable—is considered a significant factor at the landscape planning level. The EAR was first applied in 2006 to new town developments, and became a requirement in 2007 when developing housing complexes of size >3,300,000 m^2. As the government strengthened its climate change policies, the EAR was updated in 2012 to increase the minimum ratio from 20 % to 30–80 %. Despite its intention to increase the permeable areas in new developments in order to improve urban ecological systems, the implementation of the EAR has not been very effective because of a lack of legal responsibility and opposition from developers (Choi et al. 2012). The permeable area assigned as a result of the EAR at the land-use planning stage is often reduced significantly during construction and in negotiations between the developers and the Ministry of Environment. Even in projects that properly implement the EAR, the quality of the permeable areas intended for ecological water management does not tend to meet the goals of the EAR, due largely to poor design and management. The application of the same ratio of permeable area to a particular type of development regardless of the biophysical and sociocultural context of the site has also led developers to negotiate a reduction in the ratio during the construction stage.

Fig. 2 Destruction of forest and wetland due to the construction of a solar power plant in Korea (photo from http://agrinews.kr)

Landscape design approaches to climate change problems

Landscape design in Korea has also been affected by climate change policies in recent years. We have observed that the site-level landscape design approaches affected the most by climate change policies include rainwater management systems, low-impact developments (LID), and urban agriculture.

Rainwater management has become a more aggressive tool at the site design level since the government's introduction of climate change policies. In 2013, the city of Seoul strengthened its rainwater management ordinance after significant flooding events in urban centers such as the roads of Gwanghwamoon and Gangnam in the last few years. A notable revision of the ordinance includes a change of the building-to-land ratio that requires the installation of rainwater management facilities higher than before to improve urban water circulation systems. The ordinance also incorporates the LID concept to improve rainwater management systems.

LID, developed and popularly applied in the US as a landscape design tool to effectively respond to climate change and flooding problems, has received considerable attention from governmental departments in Korea. LID is defined as an approach to land development that works with nature to manage stormwater (US EPA 2013). It employs principles such as preserving and recreating natural landscape features and minimizing imperviousness in order to create functional and appealing site drainage that treats stormwater as a resource rather than a product (US EPA 2013). In Korea, the Ministry of the Environment started to apply the LID concept in 2012 to environmentally sensitive sites such as those alongside major river channels and flooding areas. The government is now pursuing a requirement for LID tools to be applied to land-use plans proposed by governmental sectors, and ultimately the private sector too.

Fig. 3 Plan for the 2-km-long Garolim tidal power plant. The plan encountered strong opposition from environmental experts due to its destructive impact on tideland ecosystems, and has now been dropped (photo from the website http://www.seoul.co.kr/news)

Urban agriculture is considered a climate change mitigation measure in urban planning and design, particularly in cities, where food security and interrelated health equity issues are important (Friel et al. 2011). In Korea, urban agriculture was adopted institutionally for the first time by central and local governments in 2012 and 2013. Its most notable influence on design is the inclusion of agricultural land as a legally acceptable land-use component in urban parks. The Korean government recently enforced a law that allows the creation of land for agricultural purposes in urban parks. The inclusion of agricultural land in urban parks is intended to provide food security, recreation, and flexible utilization of underused land in urban parks. This has significantly affected urban park design patterns, and landscape architects are beginning to propose new ideas about how agricultural lands and activities can be effectively integrated into urban parks.

Problems and future directions

Based on our review of the influence of climate change policies on landscape planning and design in Korea, we now highlight four problems and suggest implications for future directions.

First, the government's recent aggressive climate change policies have partly resulted in an adverse effect on the environment: the destruction of forest, wetlands, and tidelands during the implementation of renewable energy policies. Although the degree of environmental impact caused by the establishment of renewable energy plants is still unclear, environmental experts largely agree that the environmental costs outweigh the benefits of the energy generated when the plant is sited in an environmentally sensitive area. This implies that insufficient care was taken during the planning and design stages to find environmentally suitable locations for the renewable energy plant. Two planning and design approaches to finding environmentally suitable locations can be suggested. In regards to planning, particular guidelines for the siting of renewable energy plants aimed at the national, regional, and local planning levels should be developed in a consistent way. During the design stage, at site level, scientifically reliable methods of analyzing suitability taking into account the biophysical and sociocultural opportunities and constraints of the site must be developed and then applied to find

environmentally sound locations, along with community support.

Second, the planning and design tools that have been created to aid the implemention of climate change policies do not tend to consider local characteristics and different biophysical and sociocultural contexts. For example, LID systems are not a panacea in places where structural sewerage systems are a more efficient choice due to safety issues. Unlike most of the cities in the US, many of the major cities in Korea operate subway systems. This implies we need good coordination between structural sewerage systems and LID systems for effective water flow and management. Exclusively focusing on LID without considering how it connects with existing sewerage systems seems a rather risky approach, so more attention must be paid to how LID tools can contribute to existing water flow and circulation systems in and around the sites during the planning and design stages.

Third, because Korean climate change policies have been developed by different governmental departments, the policies are not sufficiently coordinated to allow the policy goals—mitigation and adaptation to climate changes—to be achieved. Local governments are required to reflect hazard mitigation plans in local land-use plans during the strategic planning phase, but integration is still poor and superficial, relying on conventional structure measures. Based on communications with local government officials, we found a critical need for guidelines on how landscape design can be used to effectively minimize or prevent the impacts of different natural hazards.

Finally, design tools or guidelines at site level that facilitate the implementation of climate change policies must be well developed through the application of creative ideas and empirical tests. For example, despite new policies to include LID at site level, detailed guidelines on the design and organization of LID elements have not been provided, resulting in superficial and ineffective applications of LID by developers. Thus, planners and landscape architects, in collaboration with the government, should develop guidelines for designing LID elements such as detention ponds, natural drainage channels, permeable areas, and rainwater collection systems. At the same time, empirical studies that attempt to systematically determine the combinations of these elements that work best in a particular context should be conducted to aid developers and designers.

Conclusions

In this study, we reviewed how the application of new climate change policies has affected landscape planning and design practices in Korea. Despite their ambitious goals and targets, the climate change policies developed recently in Korea have not been successfully implemented in planning and design. As observed in previous sections, it is important to be aware of the side effects of these climate change policies when the potential environmental impact and local contexts are ignored during the planning and design stages. Careful consideration of the biophysical and sociocultural characteristics of each site is also crucial when applying planning and design tools. The systematic coordination of different policies developed by different governmental departments is another challenge when attempting to achieve the common goals of climate change mitigation and adaptation.

For future research, we recommend that studies should hunt for critical evidence of why climate change policies are not well implemented in particular local contexts, and how such failures can be overcome through the application of adequate measures in planning and design.

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