

auri research brief

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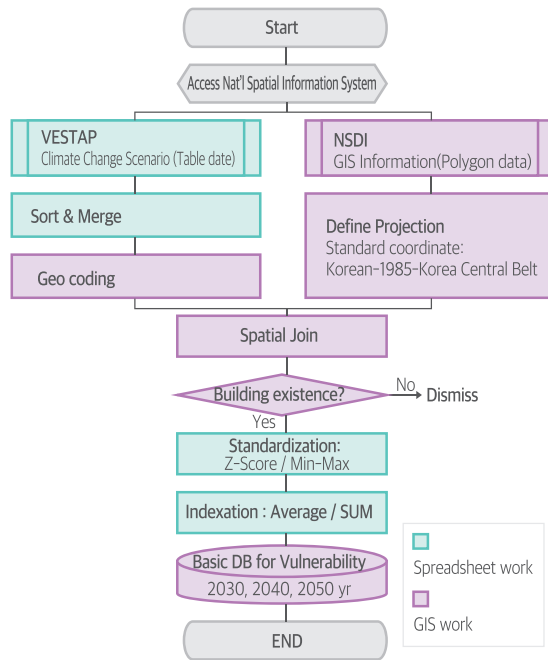
Resilient Urban Design in Preparation of Natural Disasters Caused by Climate Change

The extreme heat and torrential rain have become disastrous summer events. Although the extreme heat was lasted for 10.1 days on average since its recording started in 1973, the extreme heat in 2018 was lasted for 31.5 days. This was the record longer than the historic year of the longest extreme heat in 1994 which had 31.1 days. The pattern of summer rainfall is changing due to climate change. Summer rainfall has come in the entire season that was concentrated in monsoon period. A concern is growing not only because of increasing the number of days of extreme heat and the intensity of torrential rain but also for having various disastrous summer events together in large cities such as Seoul.

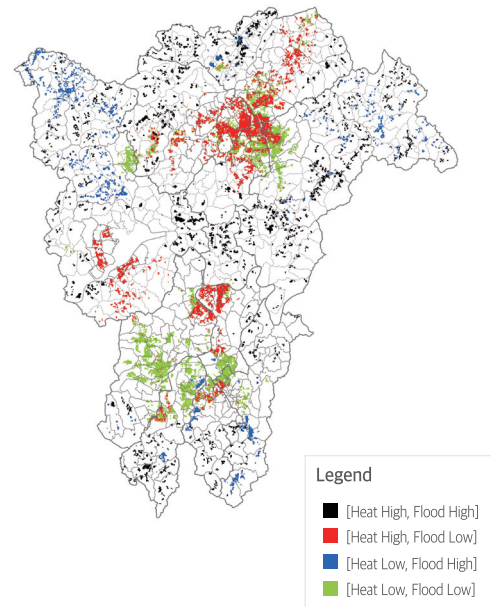
The international society has defined climate change as a severe threat to sustainable life. Some argue that climate change should be considered as a climate crisis to let the international society take more powerful counteractions. In the same context, the Paris agreement has employed a more multidimensional approach than the Kyoto protocol, which was centered on the reduction of greenhouse gas emissions, to continuously roll up the counteractions that are suitable for the conditions of individual countries. As described above, the international society requires a continuous and intensive multidimensional approach to climate change.

With the natural disasters that we have never experienced, climate change is raising uncertainty in disaster preparedness. Therefore, it is necessary to review the vulnerability to the future climate phenomena in the current construction and urban systems. To support the policies to securing resilience of the current construction and urban systems, the vulnerability review in a form agreed by the international society, such as the Intergovernmental Panel on Climate Change (IPCC), should be taken into consideration. Recent climate change is associated with the composite occurrence of natural disasters. For example, the damage by extreme heat often occurs in a vulnerable area that has already been struck by flooding that follows a torrential rain. Therefore, the review of the vulnerability of urban spaces calls for a vulnerability diagnosis process where the effects of a plurality of natural disasters are assessed simultaneously.

The natural disasters assessed in the vulnerability review of the present study are heat wave and flood, which are the representative summer disasters. If the areas are vulnerable to extreme heat and flood, the targets and methods for improving the resilience can be applied efficiently. Currently available techniques are still effective in individually assessing the vulnerability to each of extreme heat and flood. However, it is highly possible in the future that composite disasters occur in the same area simultaneously. Therefore, the present study was developed a method to assess the vulnerability to both extreme heat and flood simultaneously. The target areas of the present study were Daejeon, Sejong and Cheongju, which were combined as one region to assess the regional vulnerability and to compare the spatial distribution of the vulnerability with the local characteristics. According to the results of the composite disasters vulnerability, the extreme heat and flood vulnerability data were granted to a minimum unit area of 1 ha to prepare the spatial information. The sensitivity, employed in this study to describe the spatial status, was calculated by using the information about the affected population and buildings. The adaptability to disasters was estimated by considering the road accessibility of hospitals and educational facilities and the pedestrian accessibility to parks that serve as a buffering place.



[Figure 1]
Process of Analyzing Vulnerability Based on the Statistical Spatial Information.



[Figure 2]
A Composite Vulnerability Map Showing the Vulnerability to Extreme heat and Flood.

According to the analysis, the region was divided into four different types of areas: a building cluster vulnerable to extreme heat and flood; a building cluster vulnerable only to extreme heat; a building cluster vulnerable only to flood; and a building cluster not vulnerable to extreme heat and flood. The building cluster not vulnerable to extreme heat and flood showed a low vulnerability to the disasters, because the accessibility to buildings and urban infrastructure was high, despite the high degree of exposure to extreme heat and flood. This means that the vulnerability to the same natural disasters may be decreased depending on the physical properties of the urban areas and buildings. An on-site survey was conducted to the reaction of the individual types of clusters to extreme heat and flood. Despite the limitation of the qualitative survey results, the analysis of the conditions of the facilities and buildings showed that the vulnerability to extreme heat and flood is increasing.

Due to the current urban design system in South Korea, the introduction and expansion of the concept of resilience requires a step-by-step approach. First, the current list of natural disasters that can affect the city should be updated in consideration of future climate change. The formation of new city and the restoration of an existing city should be preceded by the establishment of the concept of resilience to apply a resilient urban plan based on the vulnerability to the natural disasters caused by climate change. Afterwards, the vulnerability

should be systematically classified with reference to the types and intensity of natural disasters according to the climate change scenarios to resolve the limitation of the physical structures in existing cities and to prepare a planning guideline in consideration of the environmental characteristic of newly developed areas vulnerable to natural disasters. Furthermore, a resilient urban design standard that describes the specific building design principles should be applied to the areas vulnerable to natural disasters according to the characteristics of the areas and continuously improved through feedbacks.

[Table 1] Directions of improving laws and systems to prepare policies for resilient urban design

Item	Legal basis	Target system	Direction of improvement
Newly formed urban areas	National Land Planning and Utilization Act	Guideline for establishing district-unit planning zones	<ul style="list-style-type: none"> • Improvement of general provisions, general principles of planning and details related to climate change • Consideration of areas vulnerable to climate change in the general principles of district designation and environmental management • Improvement of standards of establishing infrastructure in preparation of new climate • Improvement of transportation facility standards for rapid evacuation in emergency • Improvement of space configuration and form for improving resilience of buildings against climate change
Existing urban areas	Special Act on Promotion of and Support for Urban Regeneration	Urban regeneration strategy plan	<ul style="list-style-type: none"> • Including climate change vulnerability assessment in the selection of targets of an urban regeneration strategy plan • Including the areas vulnerable to disasters caused by climate change in the designation of areas for promotion of urban regeneration • Analysis of potentials related to climate issues together with the urban degeneration in the preparation of an urban regeneration strategy plan • Consideration of climate change vulnerability in determining the urban regeneration priority
Natural disasters	Countermeasures Against Natural Disasters Act	Targets of countermeasures against natural disasters	<ul style="list-style-type: none"> • Maintaining the association between the existing natural disaster impact assessment and urban projects • Addition of extreme heat countermeasures to the basic responsibility of the authorities responsible for natural disaster countermeasures

Keywords : Cimate Change Adaptation, District-unit Planning, Natural Disaster Countermeasure, Resilience, Urban Regeneration

