Supporting tool of climate change vulnerability assessment

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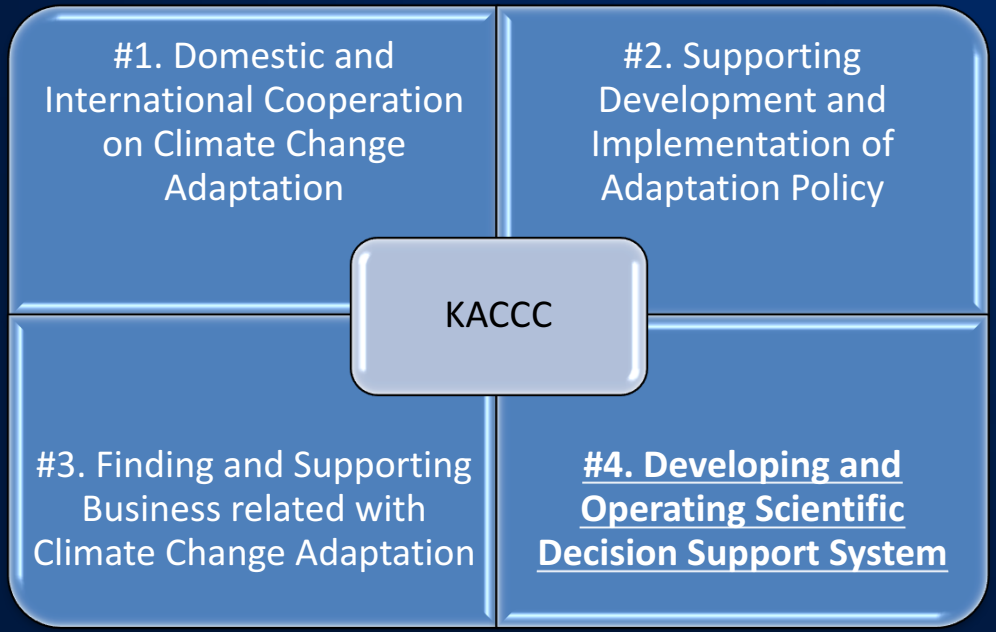
1-1. Background



- The Korea Adaptation Center for Climate Change (KACCC) has four main roles in National Climate Change Adaptation.
- For the role #4, the KACCC has developed and serviced the Climate Change Vulnerability Assessment Tool (VESTAP).

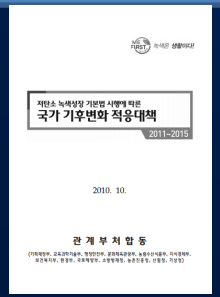
1-1. Background

Local Governments' Implementation Plan
2012-2016 for metropolitan governments
2013-2017 for municipal governments

Local Governments' Implementation Plan
2017-2021 for metropolitan governments
2018-2022 for municipal governments

2010 2011 2012 2015 2016 2017

National Climate Change Adaptation Plan (2011-2015)



2nd National Climate Change Adaptation Plan (2016-2020)

- According to the Framework Act on Low Carbon and Green Growth, the central and local governments have to make climate change adaptation plans every 5 year since 2010.

1-2. History of VESTAP Development

- The VESTAP originates from the CCGIS & LCCGIS developed by NIER.
- From the user perspective, accessibility of the GIS-based system was low.
- A web-based system, i.e., VESTAP, was developed.

Year	Name	System	Institute
2010 & 2012	Climate Change Adaptation Toolkit based on GIS (CCGIS) Local Climate Change Adaptation Toolkit based on GIS (LCCGIS)	GIS	National Institute of Environmental Research (NIER)
2014	Vulnerability Assessment Tool to Build Climate Change Adaptation Plan (VESTAP)	Web	Korea Adaptation Center for Climate Change (KACCC)

2-1. Structure of VESTAP

(http://vestap.kei.re.kr).

[Users]

[Korea Adaptation Center for Climate Change]

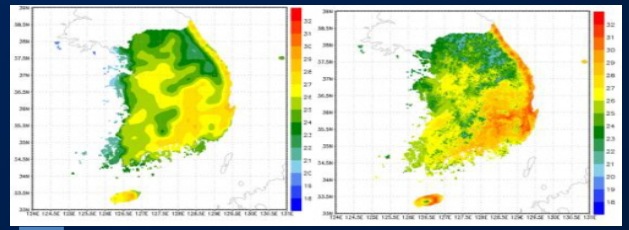
[VESTAP system]

Display

DB

[Korea Meteorological Administration]

RCP - Meteorological variables

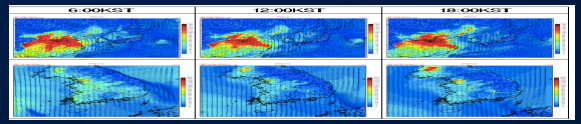


[Others]

Socioeconomic variables

[National Institute of Environmental Research]

RCP - Air quality variables



2-2. Main functions of VESTAP

[Targets provided]

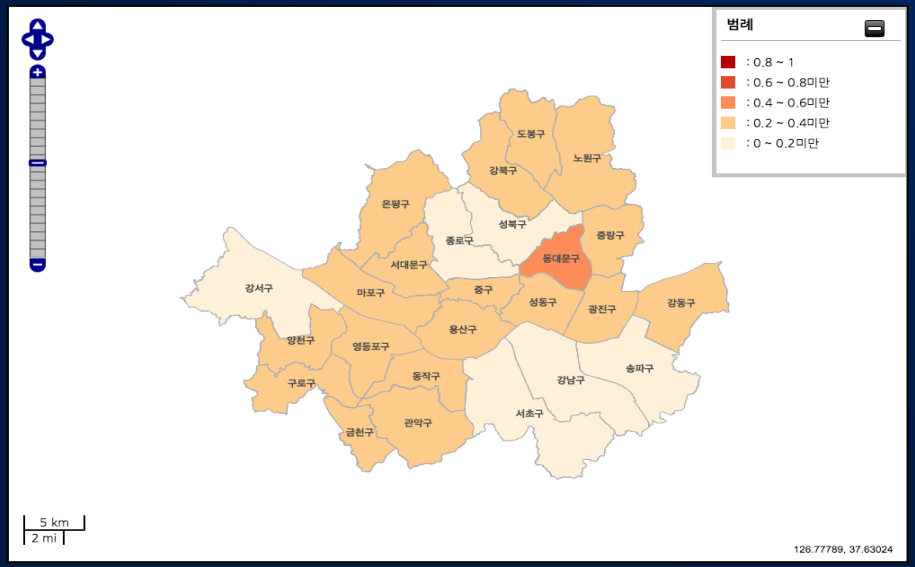
- The VESTAP provides 32 targets in 7 fields.
- The 7 fields include Health, Disaster, Agriculture, Forest, Ocean/Fishery, Water management, Ecosystem

[Customizing targets]

- Users can examine a new vulnerability target by configuring indices for each factor.

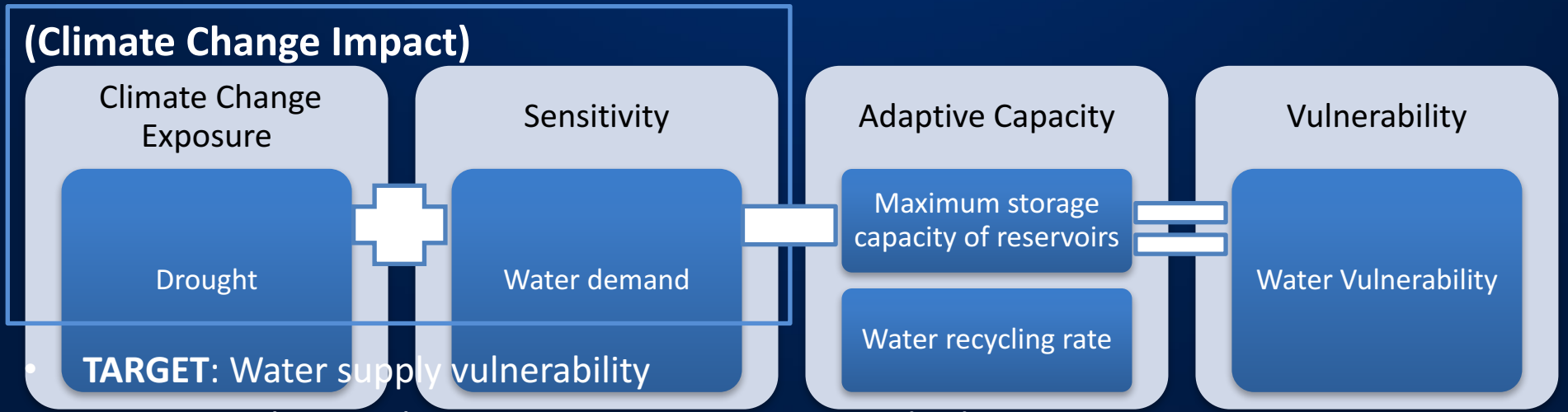
2-3. Results of VESTAP

[Thermal disease vulnerability]



- Relative vulnerability between districts within a province
- Value 1 (0) indicates that the district is the most (least) vulnerable.

2-4. Concept of Climate Change Vulnerability



- **TARGET**: Water supply vulnerability
- **FACTORS:** Climate Change Exposure, Sensitivity, and Adaptive Capacity
- **INDICES:** Drought, Water demand, maximum storage capacity of reservoirs, and water recycling rate

2-5. Detailed equation

$$Agricultural\ Water\ Supply\ Vulnerability = (\alpha \times Exposure + \beta \times Sensitivity) - \gamma \times Adaptive\ Capacity$$

where, $\alpha = 0.25, \beta = 0.25, \gamma = 0.5$

Normalization method

$$Normalized\ value = \frac{Actual\ Value - Minimum\ Value}{Maximum\ Value - Minimum\ Value}$$

Exposure		Sensitivity		Adaptive Capacity	
Indices	**Weighting**	**Indices**	**Weighting**	**Indices**	**Weighting**
Standardized Precipitation Index	0.5	Agricultural Water Consumption	1	Gross Regional Domestic Product	0.5
Evaporative Demand Drought Index	0.5			Maximum Storage of Reservoirs	0.2
				Irrigated field rate	0.3

2-6. Selection of Indices (Exposure)

- Do not use too many indices for each factor
  - Weighting value can be indistinguishable between the indices
  - Many similar indices can mislead AHP results.
- The indices should highly affect the vulnerability of target in which the user is interested.

2-6. Selection of Indices (Exposure)

Thermal diseases vulnerability			
Original indices	**Weighting**	**Revised indices**	**Weighting**
Heat index	0.15	**Days in which heat index is higher than 32**	**1**
Annual mean of daily maximum temperature	0.11		
Days in which daily maximum temperature is higher than 33℃	0.26		
Days in which daily minimum temperature is higher than 25℃	0.1		
Annual mean of daily relative humidity	0.1		
Discomfort index	0.15		
Sensible temperature	0.13		

2-7. Selection of Indices (Sensitivity)

- Divide indices for each sensitive group
  - Each sensitive group is not always correlated between each other
  - Uncorrelated indices may mislead vulnerability results
- Do not use consequences of climate change impact as indices (e.g., death rate)
  - It is already a result of combination of sensitivity and the other two factors (i.e., vulnerability).

2-7. Selection of Indices (Sensitivity)

[Correlation between low-income and elderly living alone populations]

Provinces & Megacities	Correlation coefficients	Provinces & Megacities	Correlation coefficients
Seoul	+0.83*	Gyeonggi	**−0.28***
Busan	+0.87*	Gangwon	**−0.57***
Daegu	+0.83*	Chungbuk	**−0.14**
Incheon	+0.83*	Chungnam	**−0.55***
Gwangju	+0.96*	Jeonbuk	+0.59*
Deajeon	+0.99*	Jeonnam	**−0.06**
Ulsan	+0.91*	Gyeongbuk	**+0.07**
Total	**+0.09**	Gyeongnam	**−0.37***

Thermal diseases vulnerability	
Original indices	**Revised indices**
Infant population (≤5)	**Infant population (≤5)**
Elderly population (≥65)	**Elderly population (≥65)**
Low-income population	**Low-income population**
Elderly living alone population	
Cardiovascular disease deaths	**Population having cardiovascular diseases**
Thermal disease deaths	

2-8. Selection of Indices (Adaptive Capacity)

- Classify adaptive capacity into two, potential and substantial ones.
  - Potential adaptive capacity
    - GRDP, Annual budget, etc.
    - Potential ability of local governments to reduce vulnerability
  - Substantial adaptive capacity
    - Manpower of medical institutions, Number of medical institutions, etc.
    - Ability of local governments to directly reduce vulnerability

2-8. Selection of Indices (Adaptive Capacity)

Exposure		Sensitivity		Adaptive Capacity	
Indices	**Weighting**	**Indices**	**Weighting**	**Indices**	**Weighting**
Standardized Precipitation Index	0.5	Agricultural Water Consumption	1	Gross Regional Domestic Product	0.5
Evaporative Demand Drought Index	0.5			Maximum Storage of Reservoirs	0.2
				Irrigated field rate	0.3

3-1. Limitation of VESTAP

- Only relative assessment is provided.
  - Even though vulnerability of a city is the least, that does not mean that the city is not vulnerable to climate change, but just the city is the least vulnerable than the others.
- The VESTAP cannot evaluate the vulnerability which arises from complex processes (e.g., drought → amount of water → water quality → ecosystem)

3-2. Future plan of VESTAP

- Absolute assessment method will be applied to adaptive capacity.
  - The absolute assessment can be more helpful to build detailed climate change adaptation plan.
- The integrated assessment model of climate change vulnerability is under development (http://motive.kei.re.kr).

Thank you!