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Focus Area: 1. Water as a sustainable resource

Session Title: 1A. Decision support for efficient water utilization

Schedule: [9 August 2022 | 11:00 a.m. - 12:30 p.m. (GMT+08)]

Urban Water Security Assessment in Korea Under Climate Change : A Case Study of Seoul City from a Resource Nexus Perspective

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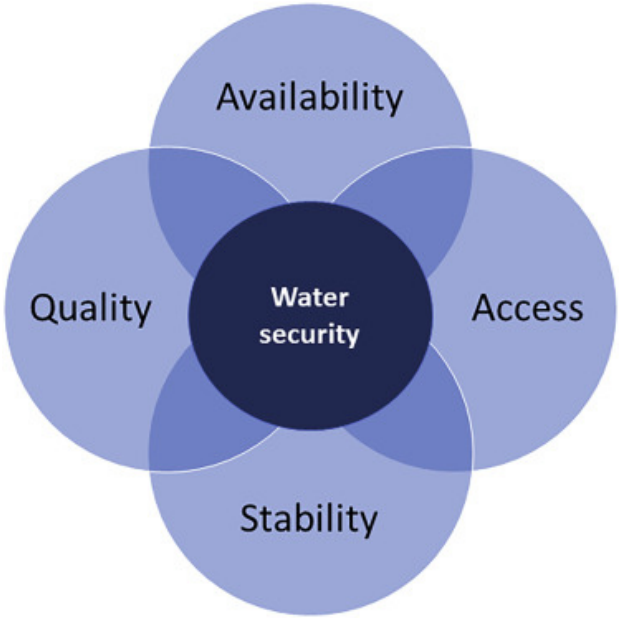
Introduction
1.1 Background



Conceptualization of water security
(Stinger et al. 2021)

Introduction
1.2 Research Objectives

Literature review

- Analyse the current policies and adaptation strategies;
- Identify the current site-specific situations, and policy interventions

Water Security Assessment

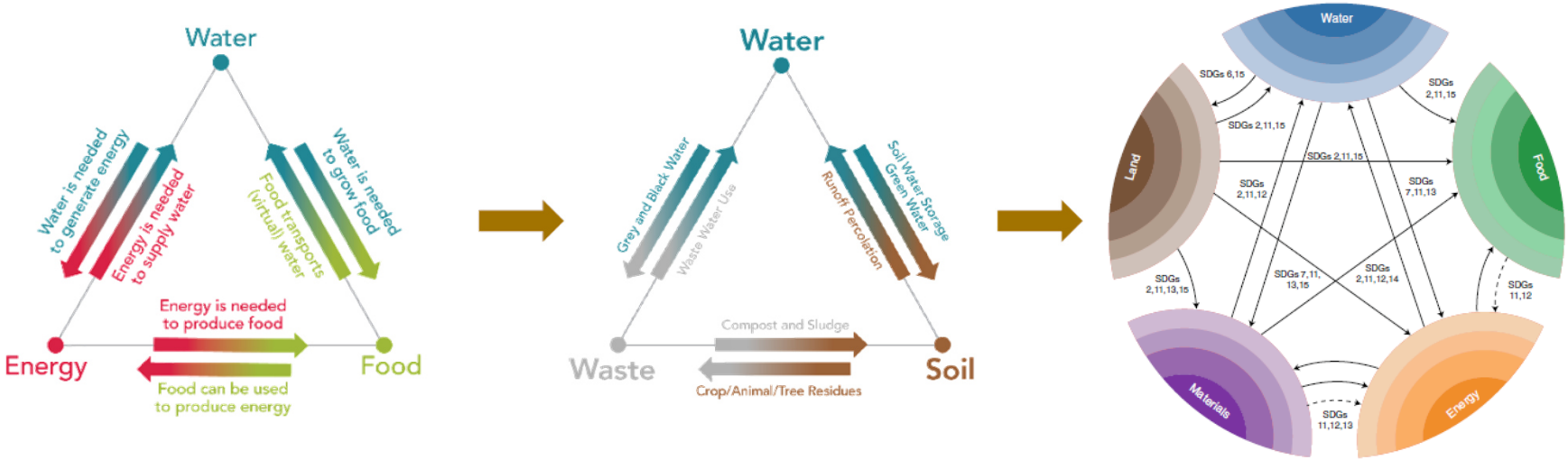
- Apply the WSA framework by using WATSAT tool
- Examine five dimensions to assess urban water security

Stakeholder Engagement

- Assess the management practices;
- Inform decision-makers on how urban water security can be framed within the context of Resource Nexus

2. Method
2.1 Resource Nexus Approach

Development of Nexus approach

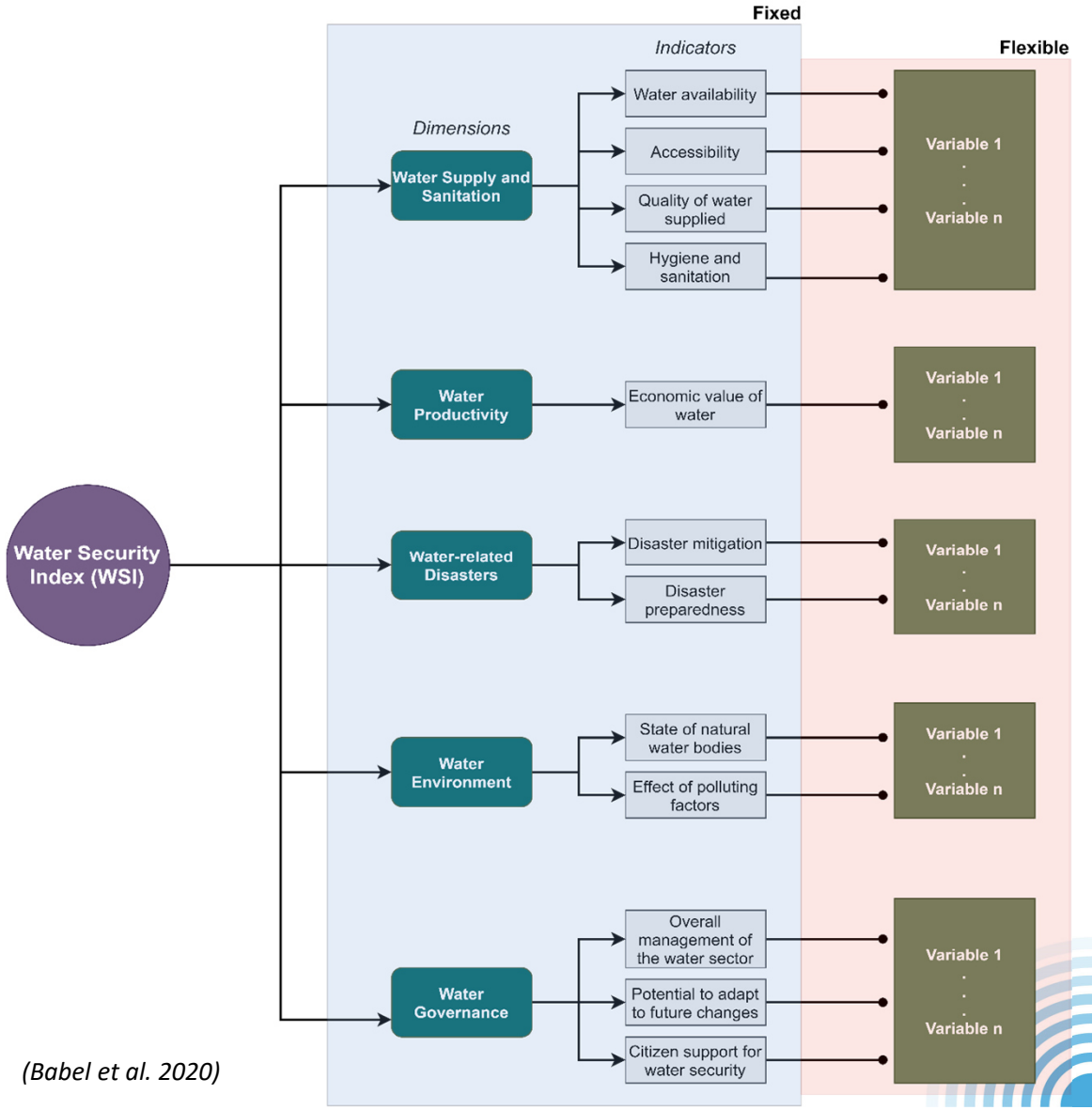


The original Nexus concept (Bonn Nexus conference, 2011): focus on **water**, food and energy **security** *(Hoff 2011)*

The **Resource Nexus**:
Integration of biotic and abiotic resources, waste and energy
(Karthe et al. 2021; Günther 2019)

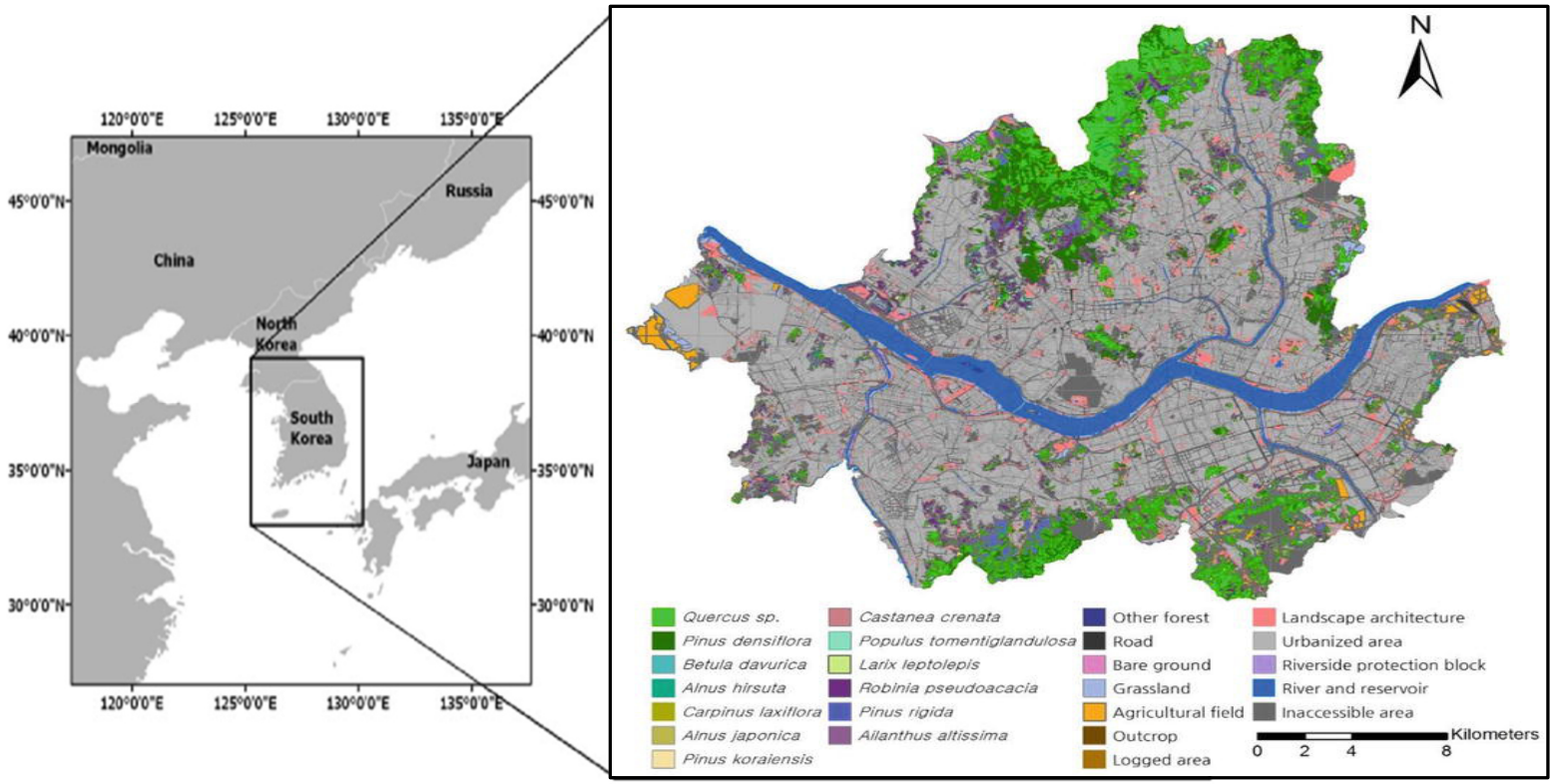
2. Method
2.2 WSA Framework

- Dimensions and Indicators are kept fixed to keep the framework generic, while variables can vary depending upon the site- specific nuances that are relevant for the city
- Indicators are based on SMART (Specific, Measurable, Achievable, Relevant, and Time-bound) criteria
- The variables are used to quantify indicators and are normalized in the range 1–5 using reference values



(Babel et al. 2020)

2. Method
2.3 Case Study Region – Seoul City



(Lee et al. 2019; Yoo et al. 2013)

2. Method
2.4 Input Data for Seoul City (2019)

	Data	Unit	Value	Source
I.	**Demographic data**			
1	City Population	persons	9,795,426	National Statistical Office (NSO)
2	Population with access to piped water supply	persons	9,530,949	Water Policy Dep. of the Ministry of Environment
3	Population with improved sanitation facilities	persons	9,795,426	Water Policy Dep. of the Ministry of Environment
II.	**Socio Economic data**			
1	No. of people living in slum area	persons	3,180	National Statistical Office (NSO)
2	Total Gross Domestic Product(GDP) of the city	USD	349,779,605,752	Seoul City Budget Management Department
3	Total city budget	USD	25,239,761,235	Seoul City Budget Management Department
III.	**Meteorological data**			
1	No. of existing rain gages	no.	47	The Korea Water Resources Corporation (K-water)
2	Optimal number of rain gages	no.	56	
IV.	**Water Supply data**			
1	Residual chlorine	mg/L	0.18	The Seoul Metropolitan Government
V.	**Water use data**			
1	Total domestic water consumption	m^3/year	1,130,189,000	The Korea Water Resources Corporation (K-water)
2	Commercial water use in the city	m^3/year	42,462,000	

2. Method
2.4 Input Data for Seoul City (2019)

	Data	Unit	Value	Source
VI.	**Sanitation and Hygiene data**			
1	Population with improved sanitation facilities	Persons	9,795,426	National Statistical Office (NSO)
VII.	**Water related Disaster data**			
1	Investment in disaster response mechanisms	USD	6,368,522,592	Seoul City Budget Management Department
VIII.	**Water Quality data**			
1	Dissolved Oxygen (DO) concentration	mg/L	11	National Statistical Office (NSO)
2	Minimum required standard for Dissolved Oxygen (DO)	mg/L	5	
3	Amount of wastewater treated	m^3/day	4,754,714	
4	Total wastewater generated	m^3/day	5,800,000	

2. Method
2.4 Input Data for Seoul City (2019)

	Data	Value	Remark
IX.	**Water Governance data**		
a)	**Institutional factor**	Yes	Each of the questions need to be answered in a yes/no format in WATSAT. If the answer is "Yes" to one of the question, then a score of 1 is given. Likewise, "No" to the question means a score of 0 is given.
1	Is public opinion sought when developing water-related plans for the city?	Yes	
2	Is there a provision for the public to register their grievance?	Yes	
3	Is there an official mechanism to monitor Non-Revenue Water (NRW)?	Yes	
4	Is there a provision to incentivize judicious water management?	Yes	
5	Does the organization consult other water organizations during the development of annual or long-term plans?	Yes	
b)	**Adaptability factor**	Yes	
1	Does recycling and/or reuse of water take place in the city?	Yes	
2	Is there a centralized database for water related information?	Yes	
3	Is there a system to forecast water availability and quality?	Yes	
4	Are future drivers of change (e.g. Climate change) taken in consideration when developing long-term city master plans?	Yes	
5	Is there a mechanism for the organizational staff to upgrade water-related knowledge?	Yes	
c)	**Public support factor**	Yes	The full contents are not shown here

Source: K-Water 2019 Survey results, Seoul Open Data Platform

3. Preliminary Result
3.1 Interpretation of the Water Security Index

WSI	Condition	Description
< 1.5	Poor Water Security	The city is highly water insecure. It faces several water-related issues. There is a lack of proper institutional management and preparation for future water challenges
1.5 - < 2.5	Fair Water Security	The city is water insecure from the perspective of some dimensions. It faces some water-related issues. The city needs some improvement in the institutional management and preparation for future water challenges.
2.5 - < 3.5	Good Water Security	The city is reasonably water secure in terms of most dimensions. It faces relatively few water-related issues. The city has some form of institutional management and has some plans to tackle future water challenges.
3.5 - < 4.5	Very Good Water Security	The city is quite water secure in terms of most dimensions. It faces very few water-related issues. The city has proper institutional management and good plans to tackle anticipated future water challenges.
≥ 4.5	Excellent Water Security	The city is highly secure in terms of all dimensions. It has almost no water-related issues. The city has excellent institutional management, and it is fully prepared to tackle the anticipated future water challenges.

3. Preliminary Result
3.1 Interpretation of the Water Security Index

Dimension	Indicator	Indicator score
Water Supply and Sanitation	Water availability	5.00
	Accessibility to water	5.00
	Quality of water supplied	4.33
	Hygiene and sanitation	5.00
Water Productivity	Economic value of water	5.00
Water-related Disasters	Disaster mitigation & preparedness	5.00
Water Environment	State of natural water bodies	5.00
	Effect of polluting factors	4.00
Water Governance	Overall management of the water sector	5.00
	Potential to adapt to future changes	3.34
	Citizen support for water security	5.00

3. Preliminary Result
3.2 Summary

- Lack of potential to adapt to future changes → **The impact of climate change should be considered** in water policies and adaptation strategies

- Seoul has a largely reactive response to water crises, which comes at a high cost. **Preventive river maintenance and the installation of emergency spillways and spillway expansions** would reduce flood risks *(OECD, 2018)*

- The Han River city has damaged aquatic ecosystems due to **water pollution**, loss of connectivity from reservoirs and low residual flows

- Future planning **need to assess land use, food and energy production** scenarios, and the effect of demographic changes on water demand for better management of water demand and quality

- Towards a **water-saving society** for energy conservation and reduction of CO2 emissions

- Water-related policies require integration of **Resource Nexus perspective** and thinking beyond sectors for sustainable development → Going beyond "Water Security Assessment" to **"Water Security Enhancement"**