TAIWAN INT'L WATER WEEK

綠色永續下 創新水戰略

Innovative Strategies for Water Sustainability

International Forum 2022

Introducer-
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Water Resources Agency (WRA),
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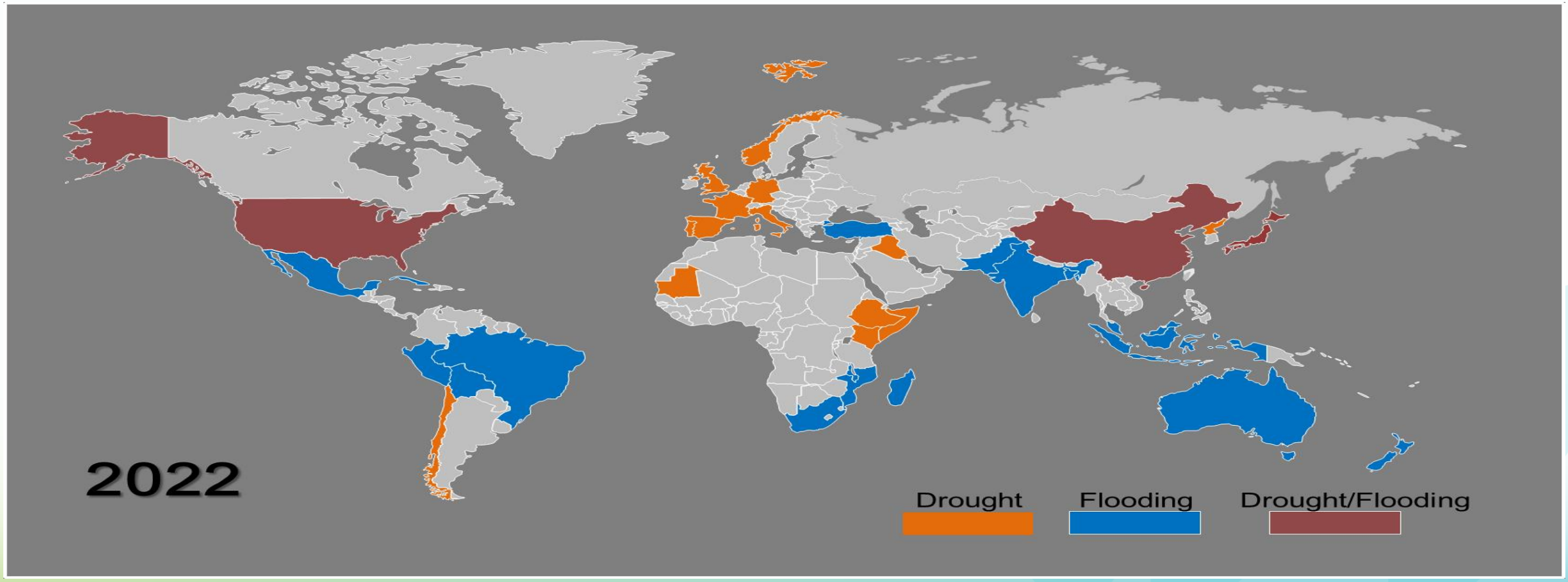
Flooding and Droughts attack the world

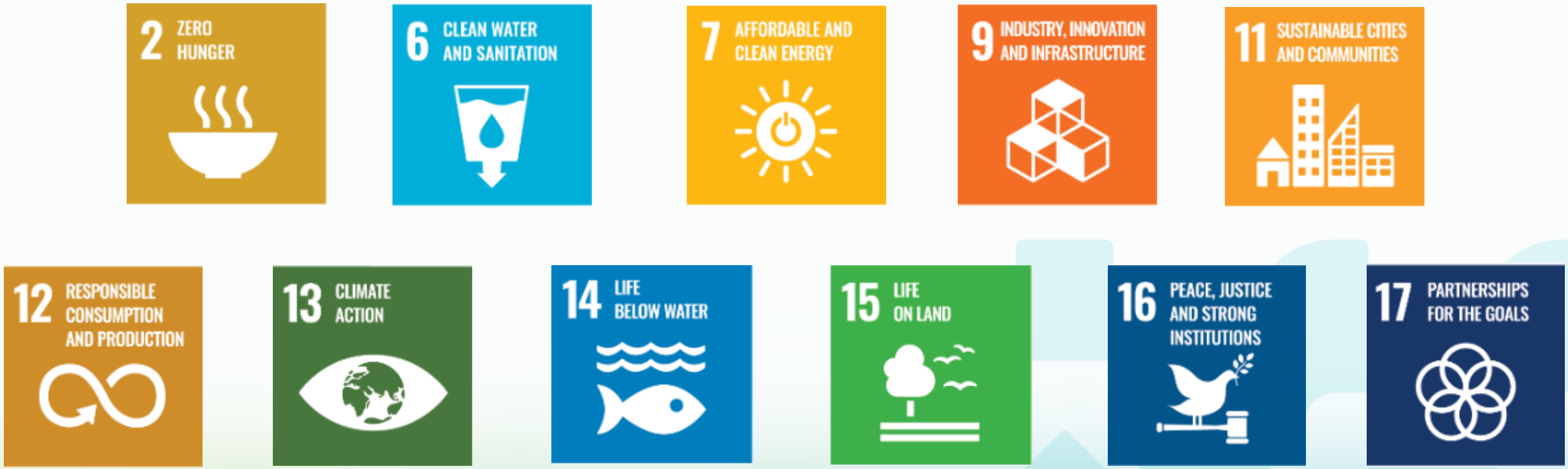
In recent years, the intensity of **storms** is **increased**, the period of **droughts** is **extended** and even the **range** of attack is **enlarged.**



Going through the serious drought in one hundred years, Taiwan has deeply felt the threat of climate change.

Facing the climate change, implementing the SDGs

Building the **resilience** is one of the most important methods to employ the **sustainable development.**



(Graphic : Business 2 Community)

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Building the resilient water city to respond the climate disasters

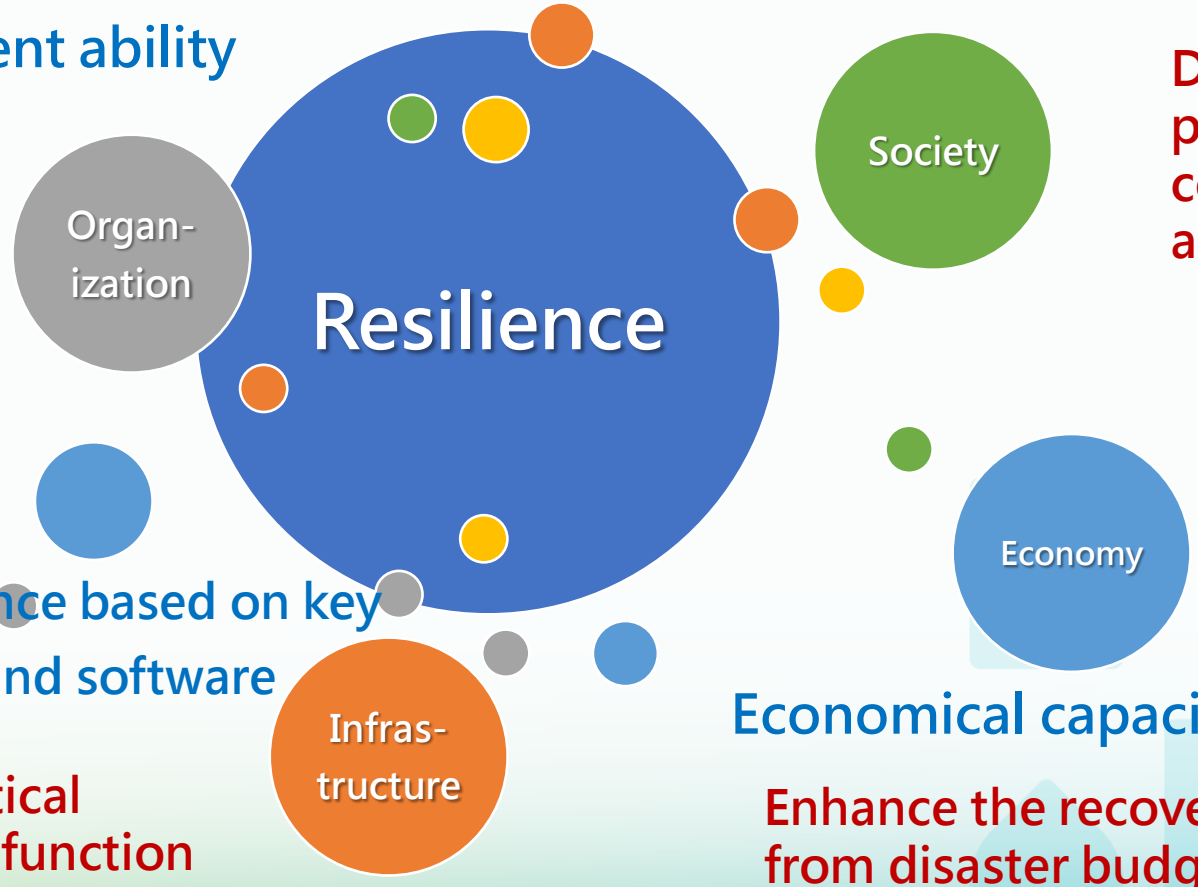
Resources of disaster prevention +rescue and management ability

The adaption ability of public sector for disaster

Exhibiting the external capability of disaster management in the city

Citizen autonomous concept of potential disaster

Developing the disaster prevention concept from the community, education, land and ecology



The ability of disaster resistance based on key fundamental hardware and software

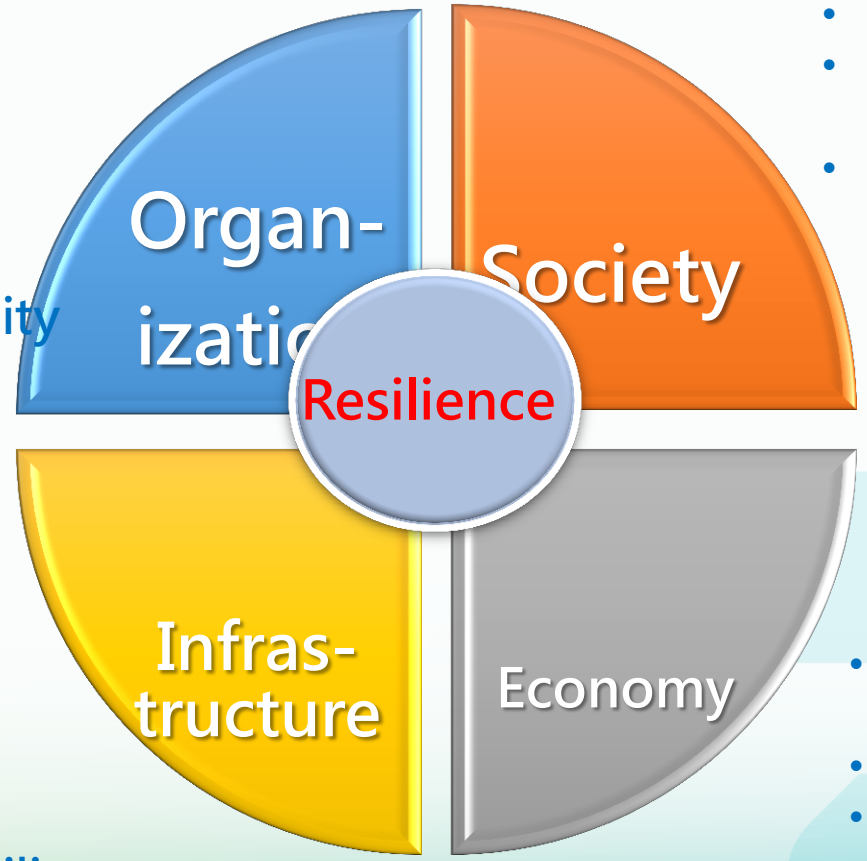
Reviewing whether the critical infrastructure can keep its function after disasters

Economical capacity for risk and recovery

Enhance the recovery capability of a city from disaster budget and enterprise participation

Develop the collaborative runoff distribution by national land and waterways

- Enhance the ability of risk recognition
- Apply the technology to promote the smart disaster prevention
- Build the watershed management platform
- Enhance the information transmission, organization communication and allocation ability



- Seeking the consensus by conversation
- Raise public awareness of risk
- Disaster prevention education training and practice
- Autonomous disaster prevention community and flood protection volunteer

- Local detention in rural area
- Runoff distribution by public facility
- Flood prevention facilities function properly

- Self-adaptation ability of enterprises facing disasters
- Resilient CSR enhancement
- Central government will consider the financial planning of disaster prevention/rescue in local

Enhancement of water supply resilience

Organization

- Enhance risk management
- Apply technology for the allocation management
- Daily monitoring for early deployment
- Cooperation platform of agriculture and business

Society

- Develop the water-saving society
- Water-saving enhancement in domestic, industry and agriculture water use

Infrastructure

- Empower the backup and allocation
- Tap water leakage reduction
- Accelerate reservoirs management
- Develop multiple water resources

Economy

- Encourage the enterprise subscription for desalination water
- Reclaimed water application in priority
- Dry farming subsidy paying for the green environment

Integrating the resilience, NBS SDGs detention in farm land

Resilience

SDGs

Organization

Inter-ministerial cooperation

Society

- Local participation
- Consultation in local
- Disaster prevention concept in rural area

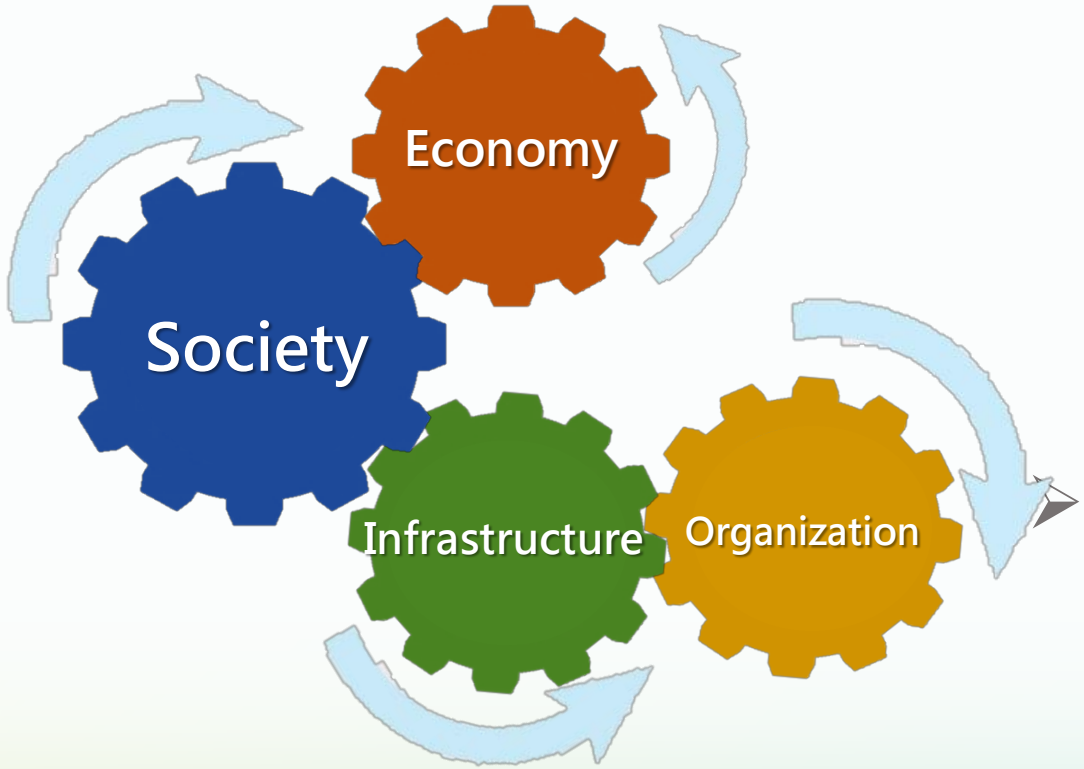
Infrastructure

- Raising the ridge
- Increase detention space in local
- Reduce the cost of construction

Economy

- Farming damage subsidy
- No land use change by land expropriation
- Maintain agriculture production environment

Facing the risk in the future, developing the resilience to exhibit comprehensive effects



- The extreme climate is unavoidable and we have to continuously improve the resilience and empower the adaption capability from **organization, infrastructure, society and economy.**
- Lean on goodness and avoid badness from organization and infrastructure; empower the adaption capability from society and economy.

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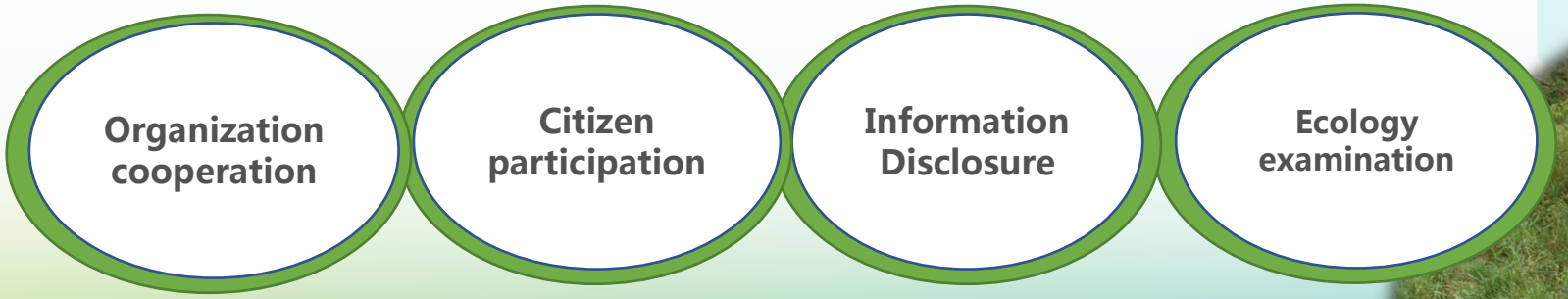
Establishing a diverse partnership, Taiwan is willing to share and exchange experiences

- Building the **resilience** is the most important **methods** to employ the **sustainable development**.
- Towards resilience, **NBS** implementation step by step from **thinking**, **action** to **system** could reach the sustainable nature for SDGs.



(Picture source: DQ)

Thank you

Carbon Reduction in Water Management

Jay R. Lund

Department of Civil and Environmental Engineering

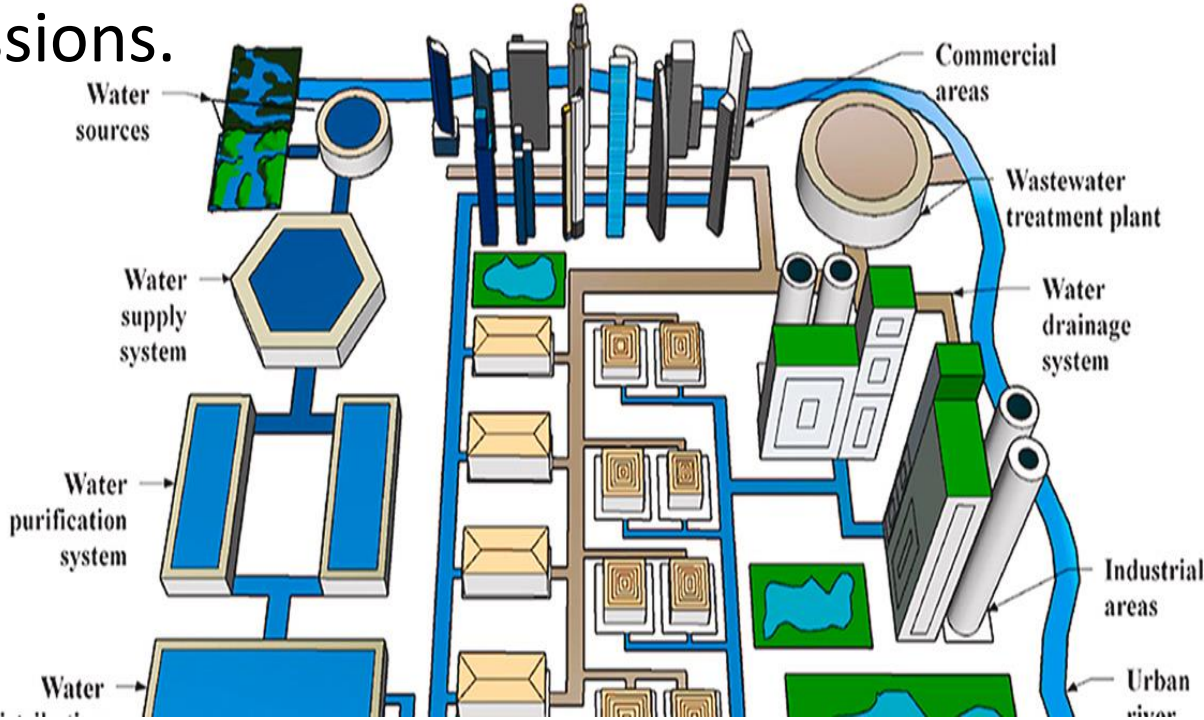
University of California - Davis

UCDAVIS CENTER FOR WATERSHED SCIENCES

CaliforniaWaterBlog.com

Carbon Emissions from Water Systems

- Water resource systems have a sizable impact on energy use and carbon emissions.
- Construction
  - Concrete cement
  - Steel
  - Fuel



- Operations
  - Energy in water treatment, distribution, and collection (pumping, treatment)
  - Heating energy for end-uses (mostly hot water for homes, business)
  - Hydropower and wastewater treatment as <u>sources</u> of energy, offsets of carbon emissions

Changing drivers of water systems

- Economic structure changes water demands (mining, agriculture, manufacturing, service economy
  - Modern service economies mostly “de-couple” economy and water use
- Technology improvements: plumbing, irrigation methods
- Cultural effects on landscape aesthetics and water use
- Ecosystems need water. We are only beginning to understand managing water for ecosystems.



Ways to reduce atmospheric carbon from water management

Construction emissions

- Concrete cement
- Steel
- Fuel

←

Avoiding new capital facilities reduces carbon emissions

Operating Activity	**Ways to reduce atmospheric carbon**
Water acquisition	Hydropower, pump timing for renewables
Storage	Hydropower, pump timing for renewables
Conveyance	Pumping and pump timing for renewables
Treatment	Pumping, chemicals
Use	**Water heating**, pumping
Wastewater treatment	Pumping, chemicals, heating
Wetlands	Sequestering carbon &/or emissions

Portfolio Elements

Water supply	
Water Source availability	**Treatment**
Capture of precipitation, fog, streams, groundwater, wastewater	Existing water and wastewater treatment
Protection of source water quality	New water and wastewater treatment
Conveyance capacities	Wastewater reuse
Canals, pipelines, aquifers, tankers (sea or land), bottles, etc.	Ocean Desalination
	Contaminated aquifers
Storage capacities	**Operations**
Surface reservoirs, aquifers and recharge, tanks, snowpack, etc.	Reoperation of storage and conveyance
	Conjunctive use
Water demands and allocation	
Agricultural use efficiencies and reductions	Ecosystem demand management
Urban water use efficiencies and reductions	Recreation water use efficiencies
Incentives to work well together	
Pricing	Subsidies, taxes
Markets	Education
“Norming”, shaming	Insurance

What is Portfolio Management?

1. Integrated use of a diverse range of actions:
   - Supplies (surface water, groundwater, reuse)
   - Demands (various)
   - Institutions (local, regional, state, federal)
2. Lower costs, more adaptable, better multi-benefit performance
3. Integration needs analytical and management effort
4. Adjust with time, conditions, technology, & problems
5. Adjustments rebalance local, regional, state, and federal actions over time – adaptive management
6. Adjustments rebalance social objectives over time.

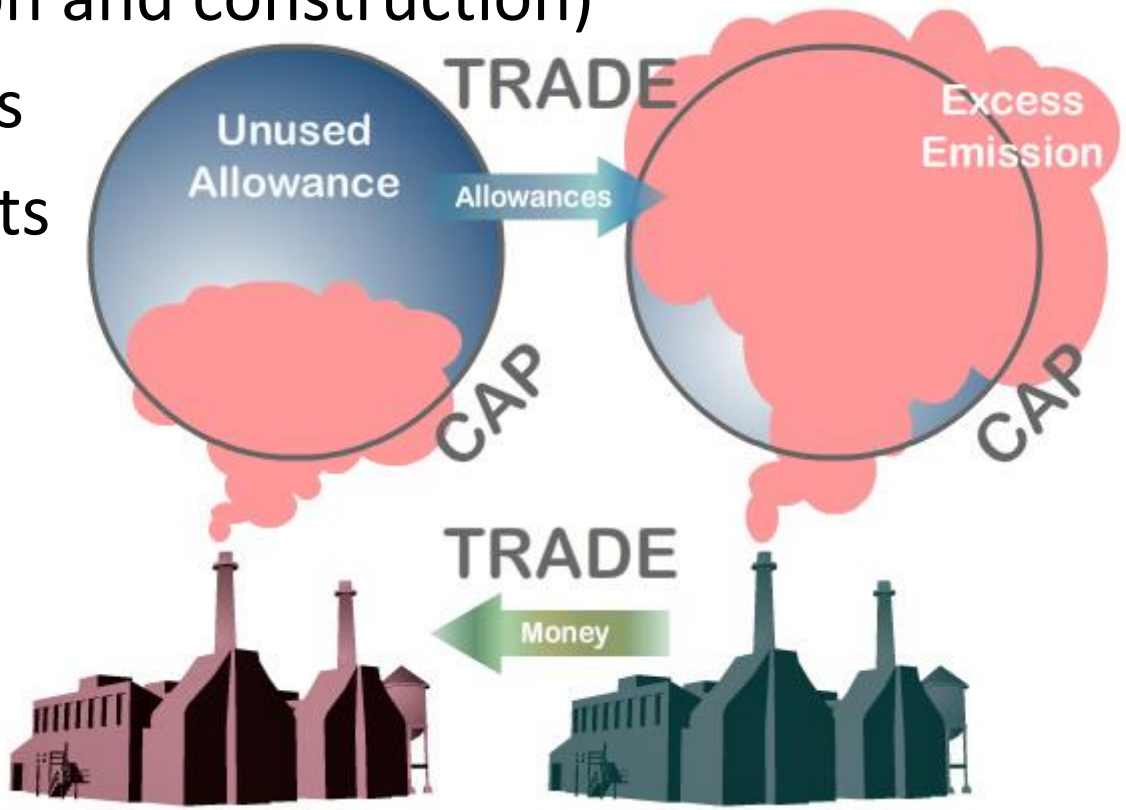
Incentives and regulations

Incentives

- Carbon taxes (operation and construction)
- Energy prices and taxes
- Sequestration payments
- Subsidies, etc.

Regulations

- Data requirements
- Emissions limits
- Cap and trade
- Technology requirements, water infrastructure and operations, use, etc.

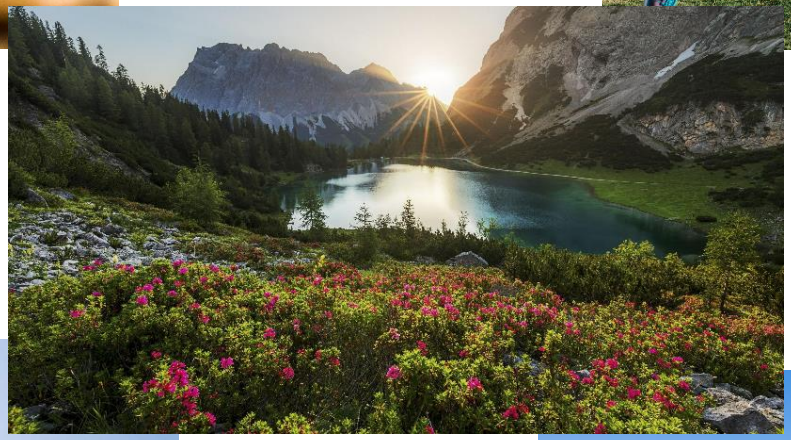


Sustainability objectives

Financial

Public health

Ecosystems

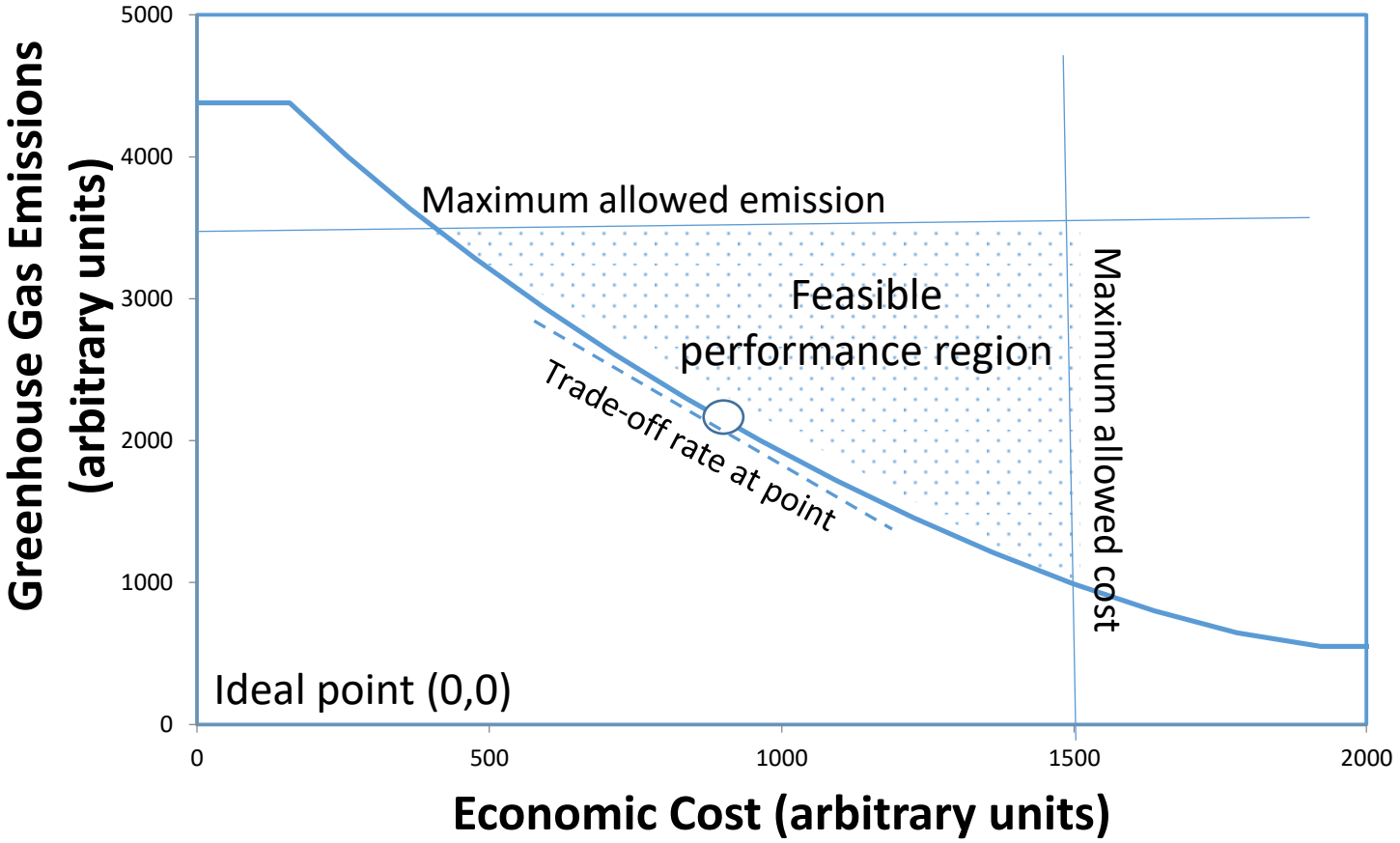


Socio-political

Economic

Sustainability Trade-Offs

- Aspects of sustainability often conflict.



- Compromises are usually necessary.

Conclusions

1. Water systems must serve a mix of sometimes-conflicting social objectives
2. A small but sizable proportion of carbon emissions globally are from water management
3. These sources are diverse and complex – both from construction and operation
4. Reducing these emissions is possible with mix of incentives and regulations
5. Modeling and analysis can help us find promising solutions and improve solutions over time.

Some Further Reading

- Escriva-Bou, A., et al, “Saving energy from urban water demand management,” *Water Resources Research*, Vol. 54, Iss. 7, pp. 4265-4276, July 2018.
- Escriva-Bou, et al. (2018). Developing a water-energy-GHG emissions modeling framework: Insights from an application to California’s water system. *Environmental Modelling & Software*, 109, 54–65.
- Liu, F. et al. (2020) “Reducing carbon emissions by integrating urban water systems and renewable energy sources at a community scale,” *Renewable and Sustainable Energy Reviews*, Vol 123, 109767
- Nair, S. et al. (2014) “Water–energy–greenhouse gas nexus of urban water systems,” *Resources, Conservation and Recycling*, Volume 89, August

Abstract

Water management is fundamental to supporting public health, economic prosperity, ecosystems, and social objectives. Success with these fundamental objectives helps provide resources and organization needed to manage water effectively. This puts water management in the core of a broad range of sustainability relationships. Among these sustainability relationships are the effects of water management and use on atmospheric carbon, and its global climate implications. This talk summarizes relationships of water management and use to society's net atmospheric carbon emissions and other sustainability implications. These are diverse and involve many individual decisions. So sustainability in water management always involves social mechanisms to encourage and incentivize collaborative behaviors among individuals and groups. The range of such mechanisms is summarized and discussed along with the trade-offs and controversies involved in employing such mechanisms. Employing a diverse portfolio of water supply, infrastructure, and use management activities, using diverse mechanisms to orchestrate decision-making, can lead to better water system performance. This portfolios approach also gives adaptive flexibility for adjusting portfolios and uses to climate change and other changes over the long life of water infrastructure and the eternal needs to manage water.

Shoot for 20 minutes, speak slowly and clearly, ~10-15 slides.