Regional Report

Regional Process Commission

Region: Asia-Pacific

ANNEX

Northeast Asia Sub-Region

Coordinator: Asia-Pacific Water Forum

Asia-Pacific Water Forum

Pre-forum version
March 2018

Northeast Asia Sub-Region

Sub Regional Coordintor: Korea Water Forum

China Focal Point: GWP China, Japan Focal Point: Japan Water Forum

1. Overview of Northeast Asian Water Resources

The Northeast Asia sub-region covers a vast territory, with a total land area of 11,764,596 km2. It borders on the Pacific Ocean, and with a total coastal line of 86,199 km and more than 22,000 islands. It is comprised of five countries, including People's Republic of China, Mongolia, Japan, Republic of Korea and Democratic People's Republic of Korea (UNEP 2008). The seas of the sub-region comprise the Yellow Sea, the East China Sea, and the East Sea which is also referred to as the Sea of Japan (Jung 2016).

The total available fresh water resources of the sub-region is 3,351 km3 excluding D.P.R Korea. The water availability per capita is 2,221 m3 which is only about 27.7 per cent of the word's average. UNEP (2008) report noted that the sub-region is water scarce, in terms of both total and per capita water resources. According to the iso-precipitation lines, about 54 per cent of the area in this sub-region is in the humid and semi-humid category while the other 46 per cent is semi-arid and arid zones. Thanks to the global agenda such as the Sustainable Development Goals (SDGs), access to the safe drinking water supply has been improved rapidly in recent years since 1990.

However, due to over-irrigation and expanded lank reclamation, lake ecosystems in the sub-region have experienced heavy pressures over the past decades causing decrease in water surface. Furthermore, water quality deterioration is another crucial issue in Northeast Asian region. Overall, the freshwater resources of the Northeast Asia sub-region exhibits a complex influence of geographic and topographic features and climates characterized as rivers flowing over long distances, large river basins, many water falls, high density of international rivers and large differences among the riparian countries (UNEP 2008).

In this paper, Northeast Asia is defined as the geographical sphere including three countries. Those three countries are China, Japan and the Republic of Korea. The table 1 shows the basic indicators of the three nations.

Table 1. Status of Northeast Asian Countries.

	Land Area (km^2) (2017)[1]	Total Population (2016)[2]	GDP (US$) 2016[3]	Per Capita GDP[4] (US$)	Annual precipitation (mm) (2014)[5]	Internal Renewable Freshwater Resources (km^3 per inhabitant) 2014[6]
China	9,388,211	1,379 Million	11,158 billion	8.59 thousand	534 (Beijing) 1157 (Shanghai)	1,999
Japan	364,560	126.99 million	4,384 billion	38.55 thousand	1,688	3,394
Republic of Korea	97,480	512,46 Million	1,378 billion	29.73 thousand	1,274	1,289

2. Water Security in Northeast Asia

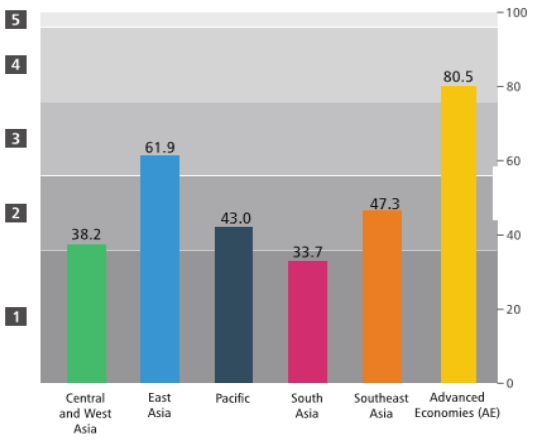
According to the definition proposed by UN-Water, "The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability." (UN-Water).

In spite of major remaining challenges such as overexploited groundwater, demand from rising populations and climate variability, according to a new report from the Asian Development Bank (ADB) published in 2016, water security in Asia overall has progressed in the past five years. A total of 38 out of 49 economies in Asia and pacific were found to be water insecure with a National Water Security Index of 2 or less based on a data of 2013. However, this has improved to 29 out of 48 economies being categorized water insecure in 2016.

East Asia shows a promising score of 61.9 in National Water Security Index while advanced economies where Japan and Republic of Korea are included show the highest NWS index score of all continents which is 80.5. National Water Security Index includes scores from the five key dimensions measuring water security of all nations; Household water security, economic water security, urban water security, environmental water security and resilience to water-related disaster. (See the Figure 1) Advanced Economies where Republic of Korea and Japan included marks the highest score.

[1] World Bank Databank https://data.worldbank.org/indicator/AG.LND.TOTL.K2
[2] Ibid. https://data.worldbank.org/indicator/SP.POP.TOTL?locations=Z4-CN&view=chart&year_high_desc=false
[3] World Economic Outlook (2017) IMF data mapper
http://www.imf.org/external/datamapper/NGDPD@WEO/OEMDC/ADVEC/WEOWORLD
[4] Ibid. http://www.imf.org/external/datamapper/NGDPDPC@WEO/OEMDC/ADVEC/WEOWORLD
[5] World Bank Databank https://data.worldbank.org/indicator/AG.LND.PRCP.MM
[6] Asian Development Bank(ADB), Key indicators for Asia and the Pacific 2017 48th edition, Downloadable at www.adb.org/ki-2017

Figure 1. National Water Security Index Score



Source: Asian Water Development Outlook 2016 (ADB)

The table 2 compares the National Water Security index of People's Republic of China, Japan and Republic of Korea in 2013 and 2016. As shown from the table, the three nations equally show progress in the National Water Security Index from 2013 to 2016.

Table 2. Comparison of National Water Security Index for Three Nations

Country	2013 (1-100)	2016 (1-100)
China, People's Republic of	44.3	61.8
Japan	74.6	80.7
Korea, Republic of	57.8	74.4

Source: ADB AWDO (2016)

The next chapter will shed light on the three nations' case studies as the practical solutions to the complex local water challenges, which will eventually contribute to enhancement of water security of the North-east Asia regional water security. Following are the efforts from regional actors representing the solutions being realized in the cases of recovery of ecosystems, creation of efficient and sound water cycle, practical responses to climate change including degradation of water quantity and quality.

3. Case Studies (China, Japan and Korea)

Case Studies (Case Study 1: China)

- Theme Title: Ecosystems
- **Topic Title: IWRM for ecosystem restoration**

Significance of Case

Heihe River, the second largest inland river in China, flows through the arid northwestern China and ends in the Ejina region. Due to limited rainfall and increasing water demand in the basin, the downstream flow declined rapidly in the late 20 century, and the river dried out before reaching the terminal lake (Juyan Lake). The Heihe River Authority was established in 2000 to carry out basin-wide integrated water resources management, and its work has proved to be successful in restoring the ecosystem of downstream regions against desertification.

Intended Outcomes and Methodology

In order to conserve water and increase downstream flow, the Heihe River Authority made basin management plans and implemented a series of measures. For the headwater and upstream areas, the overgrazed grasslands were fenced for recovery and forests were protected to reduce erosion. For the middle reaches, significant efforts have been made in agricultural sector to improve irrigation efficiency. In populated regions, water-saving strategies were promoted and infrastructures were upgraded. Water diversions from the mainstream were restricted and withdrawals were limited. Most importantly, the Heihe River Authority strategically set schedules for water dispatching, for example concentrating the discharge in spring, allowing as much as water to reach downstream regions and provide water for vegetation growth. The dispatching plans were made based on analyses of water supply and demand in the basin and adjusted in time based on monitoring data. In addition, the Heihe River Authority explored to integrate the basin management (i.e. basin organization) with the administrative management (i.e. local government), clearly defined the responsibilities of each party and established coordination systems.

Progress of the Case (Benefits, Challenge, Opportunity)

The integrated approach was proved to be successful in Heihe River Basin. After more than ten years of implementation, the annual discharge entering downstream has increased by 241 million cubic meters and the annual discharge entering the Ejina has increased by 188 million cubic meters. The flow time has been extended by 120 days and the situation of no flow in downstream has been ameliorated. The severe ecosystem degradation in Ejina region has been restrained and the signature vegetation (Populus) has recovered. The Heihe river now feeds into the East Juyanhai (which was dried up), fosters aquatic ecosystems and boosts biodiversity. Most ecological functions have been restored in Ejina after two decades of management, yet it still requires careful planning and strict implementation to overcome upcoming

challenges due to population growth and climate change. Besides, the improvements of ecological environments in Heihe River Basin also help to reduce the sandstorms in northern China.

Implication

This case provides a new model for integrated inland river basin management. Managing a river in the arid region needs an integrated approach, because the contradiction between increasing water demand and limited supply could lead to a significant decline in downstream flow that degrades ecosystems. With strategically planning of water dispatching and effective implementation through the coordination system, not only the environmental flow of the river could be maintained, but also the availability of water for ecosystems could be improved and desertificated region could regain vitality.

Useful Resources

GWP ToolBox Case Study
http://www.gwp.org/en/GWP-China/about-gwp-china/news-list/News-Flow/Water-Resources-Regulation-in-Heihe-River-Basin-/

- Theme Title: Water Cycle
- **Topic Title: Creation and Restoration of Sound Water Cycle for Sustainable Development**

Case Studies (Case Study 2: Japan)

Significance of Case

Water, in the process of the water cycle, fosters the people's life and plays an important role in the industrial and cultural development. However, various factors such as rapid urbanization, changes in industrial structure, climate change etc. give negative impacts on the water cycle and cause water problems such as droughts, floods, water pollution and deterioration of the ecosystem, which is a serious threat to the sustainable development.

Considering the above situation, a new legislative framework has been established to make circumstances that the concerned parties cooperatively deal with water-related problem in an integrated manner, aiming to keep and restore a sound water cycle.

Intended Outcomes and Methodology

"Basic Act on Water Cycle" was enacted, with the purpose of promoting comprehensive and integrated measures to establish and maintain a sound water cycle.

The Act has the five basic principles of "importance of the water cycle", "public nature of water", "consideration for sound water cycles", "comprehensive river basin management", and "international cooperation on water cycles".

According to the Act, the government should prepare a "Basic Plan on Water Cycle" and ,on the basis of the Basic Plan, should take nine measures of "River Basin Cooperation", "Maintenance and improvement of Water Retention/Recharge Function", "Adequate and Effective Water Use", "Education of Sound Water Cycles", "Voluntary Activities by Private Entities", "Research for Developing and Implementing Water Cycle Measures", "Promotion of Science and Technology", "International Partnerships and Cooperation", and "Human Resource Development in Water Cycles" in an integrated and systematic way.

In addition, the "Basic Plan for Water Cycle" has two key points as followings;

- ✓ "Comprehensive River Basin Water Cycle Plan" drawn by a "River Basin Water Cycle Council" consisting of the central and local government, business entities, organizations, and local residents etc.
- ✓ "Groundwater management" by all kinds of stakeholders through the "Groundwater Council" consisting of the central and local government, groundwater users and other related parties.

Progress of the Case (Benefits, Challenge, Opportunity)

"Basic Plan on Water Cycle" enables the local stakeholders and the related organizations to share common goals and issues and work together to solve them.

<u>Example 1: Groundwater Management</u>

Local stakeholders and related parties determined on cross-sectional measures (Sharing of basic data, Monitoring of the groundwater condition, Upper limit of volume of groundwater extraction, and Guideline for balanced utilization and conservation of groundwater) through due consultation with each other, which made groundwater conservation and sustainable groundwater utilization possible.

<u>Example 2: Conservation and Recovery of water environment</u>

Stakeholders in the basin set a common goal and vision and formulated a water quality improvement plan that decided clearly roles and responsibility of each stakeholder.

Example 3: Promotion of Education / Raising Public Awareness

Active efforts by Citizens, and joint efforts of the public and private sectors(Water conservation activities at schools, Events related to "Water day (1st of August)" and "UN Water day (22nd March)", river beautification activity etc.) have been implemented.

Example 4: Prompt and Smooth Response to Severe Droughts

The measures to minimize the effect on daily life and economy (such as early restriction on water intake, flexible water use between related parties, emergency water supply etc.) will be considered in advance (at normal times) by local related parties and water users.

Implication

This case provides a new model for sustainable water utilization by associating artificial water use with natural water cycle.

This effort is expected to promote comprehensively and efficiently participation of multi-stakeholders, partnership beyond sectionalism, nature-based approach, water recycling, integrated surface and groundwater management, because this new legislative system creates coordination platform "river basin water cycle council" where all stakeholder make consensus, and because it requires to make a comprehensive water cycle plan which enables the stakeholders to mutually cooperate in a flexible manner to implement each measure according to the common vision.

Useful Resources

http://www.narbo.jp/data/01_events/materials_6thgm/1_00.%20Key%20Note_Mr.%20Mizukusa_MLIT%20JAPAN.pdf
http://www.mlit.go.jp/tochimizushigen/mizsei/water_resources/contents/responding_properly.html

Case Studies (Case Study 3: Japan)

- Theme Title: Climate
- **Topic Title: Managing risk and uncertainty for resilience and disaster preparedness**

Significance of Case

Most of Japan's land area is mountainous. A half of the total population and 75% of the total physical assets are concentrated in flood-prone areas. Japan's rivers are also steep and short. Located in the Asian monsoon belt, Japan has suffered from many severe water-related disasters. Learning from past experiences, it has enhanced their capacity to prevent and response to such disasters.

As the disaster risks, however, from climate change and mega-earthquakes increase, low-probability, high-impact extreme events poses a great challenge.

Intended Outcomes and Methodology

Water-related disaster management in Japan, which deploys a combination of structural and non-structural measures at all stages of its management, has been developed with the principle of preventing the recurrence of disasters and leaving a more disaster-resilient nation to posterity, learning lessons from repeated experiences of disasters. In particular, it has been focused on well-planned implementation of preventive measures at the pre-disaster phase for water-related disaster risk reduction.

Progress of the Case (Benefits, Challenge, Opportunity)

On 11 March 2011, a 9.0 magnitude earthquake occurred in the Pacific Ocean off the coast of Tohoku, causing a giant devastating tsunami that greatly exceeded the design capacity of the defense structures. The tsunami left about 20,000 people dead or missing and caused the total collapse of about 130,000 buildings. The economic losses amounted to 16.9 trillion yen.

Learning from those lessons, understanding the importance of the 'assumption of hazards of any possible magnitude', a new law, The Act on Regional Development for Tsunami Disaster Prevention has been enacted. This law promotes tsunami countermeasures of 'multilayered protection' that flexibly apply structural and non-structural measures depending on the probability and scales of tsunamis with a perspective on the comprehensive regional development. The law also authorizes prefectural governors to determine and announce the possible extent of tsunami inundation. Using these projections, municipalities can develop regional development plans for tsunami disaster prevention. Currently, tsunami inundations assumptions are set in 70% of total prefectures and municipalities have developed their plans (as of Nov. 2017).

Implication

The experience of Japan shows that disaster prevention is important to lay the foundations of economic growth and its social stability and protect the fruits of development. Addressing low-probability, high-impact extreme events requires an integrated strategy, combining structural and nonstructural measures appropriately.
Japan's example also presents good case of transforming a disaster into an opportunity to build a more disaster-resilient region with greater reduction of disaster risks.

Useful Resources

Tachi, K. (2015). Lessons learned from mega-disasters and future policy development on water-related disaster management in Japan. *Water Policy* 17 (2015) 25–40.

Case Studies (Case Study 4: Japan)

- Theme Title: Ecosystems
- **Topic Title: Ensuring water quality from ridge to reef**

Significance of Case

Human activities and water use in the upper basin have a great impact on both water quality and quantity in the lower basin. The experience of Shiga Prefecture shows a good practice of how to implement the polluter pays principle on the ground.

Intended Outcomes and Methodology

Lake Biwa is the largest lake in Japan, and one of the world ancient lakes. Its values range widely, as rich nature environment, as water source, as water industry site. Now, it supports the daily living water for 14.5 million people, and the industrial water in Kinki District.

Every stakeholder such as residents, local governments and private companies in Shiga Prefecture play a key role to improve water quality of Lake Biwa, which is located in the most upper region of the basin.

Progress of the Case (Benefits, Challenge, Opportunity)

In the late 1960s, the high-growth era, pollutant load increased in Lake Biwa because of population growth and increasing number of factories. And the deterioration of the water quality became serious problem. Meanwhile, in May 1977, large outbreak of the red-brown plankton which gave off offensive odor in Lake Biwa occurred.

The one of the causes was phosphorus contained in the synthetic detergent. Consequently the citizens started "Soap Movement" to stop using phosphorus contained detergent, and to use soap powder made of natural oil materials.

In 1978, in the momentum to use of soap powder, the citizens, mainly housewives, formed "the Prefecture Liaison Conference" of the campaign to protect Lake Biwa by promoting soap powder usage. This liaison conference played a key role and strongly demanded immediate measures by the government.

It led the prefecture to enact "the Ordinance for the Prevention of Eutrophication" in 1977, which applies the effluent control of nitrogen and phosphorus over the industrial drainage. To make factories and enterprises comply with the standards, Shiga Prefectural Government strengthened the on-site inspections as well as instructions and consultations for the effluent improvement and took measures to support them to equip and maintain wastewater treatment facilities technically and financially. These measures include preparing the technical manual, organizing its briefing sessions by the type of industry, conducting training, and providing the loan with lower rate of interest in long term. In addition, it has established advanced regulations and implemented the conservation plans of Lake Biwa.

Private companies made every effort to improve their facilities. Currently, they even perform voluntary actions such as defining of their own criteria that are higher standards than the regulations.
As a result, the phosphorus concentration in Lake Biwa decreased drastically and keeps being low-level.

Meanwhile, Shiga Prefecture has been attracting the manufacturing industries. The ratio of secondary industries in Gross Prefecture Product is the highest in Japan. Prefecture Total Production per Citizen is placed fourth. Shiga Prefecture accomplished the development as one of Japan's outstanding "Manufacturing Prefectures."

Implication
Residents/consumers' voluntary and concrete actions can make a difference to the whole society. Practical guidelines and instructions, consultations and training are useful to implement solutions. These measures as well as economic instruments will support regulatory frameworks. This case shows that we can achieve economic development while also addressing environmental challenges.

Useful Resources
Water Environment Business of Shiga: Industry know-how & technology around Lake Biwa (2017). Commerce and Industries Policies Division, Department of Commerce, Industry, Tourism and Labor, Shiga Prefecture, Otsu, Japan

Case Studies (Case Study 5: Republic of Korea)

- Theme Title: Climate
- **Topic Title: Development of BANPOL model to estimate flow, sediment a nd pollutant discharges from basin areas to surface water due to climate changes**

Significance of Case
The Intergovernmental Panel on Climate Change (IPCC) finalized the Fifth Assessment Report (AR5) in 2014. The most important message of the report is that warming of the atmosphere and ocean system is unequivocal and there is a clear human influence on the climate. IPCC also reported climate change model (GCM) simulations for AR5 with 4 different prescribed CO_2 concentrations scenarios by the year 2100. Analysis of vulnerability and adaptability are necessary to develop counter measures for unwanted outcomes from climate change. However, these processes are highly complicated as many sectors affect to each other in various ways. Korean scientists gathered together to develop a comprehensive model to interconnect sectoral models

to estimate impact of climate change under different scenarios. The BANPOL (Basin Nonpoint-Source Pollutant Load) model is being developed in the water sector to estimate effect on surface waters under various climate change scenarios.

Intended Outcomes and Methodology

The BANPOL (Basin Nonpoint-Source Pollutant Load) model is developed to predict flow rate, sediment and water quality in surface runoff during rainfall and groundwater movement to surface water. It is desired that the BANPOL model will provide boundary conditions to water quality model to develop counter measures for algal blooms or toxic material in surface waters. Since Korea is highly populated and also rapidly urbanized, no existing hydrological model only is not appropriate to accurately predict flow and water quality. Therefore, the BANPOL model was developed by combining modules from few different models in public domain. Hydrological module of the model is based on SWMM model of USEPA, sediment module is similar to SWAT model of USDA and water quality interaction was developed considering many surface water quality models such as QUAL2K and WASP of USEPA.

Progress of the Case (Benefits, Challenge, Opportunity)

The BANPOL model can calculate dynamic information of water quantity and quality under different climate conditions. Therefore, this model can consider effect of forest due to climate change by considering land use information. This model also can provide water quantity and quality information to other sectors such as ecosystem or agriculture. However, any model requires verification and significant amount of field data are necessary. Our research team operates automatic monitoring system that can collect water quantity, quality and sediment data on a continuous base. Intensive field campaign will be implemented during rainfall events to calibrate model.

Implication

Korea wants to be prepared for the support or management of 1) social infra structures, 2) vulnerable class, 3) national safety, 4) conervation areas, 5) food security and 6) water resources for any climate change cases. Under this project, health, water, agriculture, forest, ecology and coastal teams are working together. The BANPOL model can be used as a part of Meta model for Korea to evaluate vulnerability and adaptability for various climate change scenarios.

Useful Resources

http://motive.kei.re.kr
http://impressions-project.eu

Reference

http://www.un.org/waterforlifedecade/asia.shtml
http://www.gwp.org/globalassets/global/toolbox/publications/technical-focus-papers/tfpchina_2015.pdf

http://www.mwr.gov.cn/english/mainsubjects/201604/P020160406508110938538.pdf
http://documents.worldbank.org/curated/en/388891468216271286/China-country-water-resources-partnership-strategy-2013-2020
http://www.wepa-db.net/policies/state/japan/japan.htm
http://siteresources.worldbank.org/INTEAPREGTOPENVIRONMENT/Resources/WRM_Japan_experience_EN.pdf
http://isdp.eu/content/uploads/images/stories/isdp-main-pdf/2016-jung-environmental-challenges-cooperation-northeast-asia.pdf