WWWeek At Home: NoWNET Session

"Co-Benefits of Implementing NBS for Water Resources and Flood Risk Management"

27th August 2020 10 am CET

Outcome Report

Objective

NoWNET, organized a webinar entitled "**Co-Benefits of Implementing NBS for Water Resources and Flood Risk Management**" with NoWNET partner organizations as a part of Stockholm World Water Week (WWWeek) at Home.

Webinar title	"Co-Benefits of Implementing NBS for Water Resources and Flood Risk Management"
Date and time	27th August 2020 10:00 -10:45 CET (17:00-17:45 Japan and Republic of Korea Time)

This webinar shared practices and lessons learned from the NoWNET members' countries, especially from Denmark, the Netherlands, Sweden, Japan and the Republic of Korea, with regards to Nature-based Solutions (NBS) in addressing water-related disaster risks from river flooding and urban flooding, to overcome existing and future challenges and for scaling-up. The discussion included how to:

- ✓ transpose the theory of the NBS to practices on the ground, in terms of technical and institutional operations, multi-stakeholders' participation, as well as the application of the socio, economic, and environmental cost & benefit analysis,
- ✓ identify and manage interactions between water, energy, land use, and ecosystems,
- ✓ apply NBS to crowded areas, and
- ✓ evaluate co-benefits and trade-off methods to assist in decision-making.

Program

10:00 - 10:02	**Introduction of the NoWNET and this session** Yumiko Asayama, Secretariat of NoWNET c/o Manager, JWF
10:02 - 10:27	**Cases from NoWNET member countries** ✧ **Denmark** **Mr. Jesper Goodley Dannisøe**, Director, Danish Water Forum ✧ **Netherlands** **Dr. Elisabeth Ruijgrok**, Public Goods Economist, Witteveen+Bos

	✧ **Sweden** **Dr. Anna Tengberg**, Programme Manager, Swedish Water House, adjunct professor at Lund University Centre for Sustainability Studies ✧ **Japan** **Prof. Takashi Asaeda**, Professor Emeritus, Saitama University ✧ **Republic of Korea** **Prof. Lee-Hyung Kim**, Civil and Environment Engineering Dept. Kongiu National University
10:27-10:42	**Panel Discussion & Interaction with the audience** Moderator: Mr. Ravi Narayanan Councilor, Japan Water Forum Panelist: Above Presenters
10:42 - 10:45	**Summary and Wrap up**

Summary of speakers' presentation

Mr. Jesper Goodley Dannisøe, Director, Danish Water Forum, shared one of the cases in Denmark. Torrential rains in 2011 and 2014 made Denmark start thinking about using other than traditional under-ground concrete solutions to cope with heavy rain. Nature-based systems came up as perfect alternatives to the concrete solutions, although accepting that a combination of the two would here and now be the way forward. The next step was to develop various prototypes for different conditions and then get the public involved as many of the solutions would emerge in e.g. parks and green areas. He shared the one of the great success of the application was the presence of mutual benefits of working together across all stakeholders and giving everybody a change to have the influence on the ground, including some applications of citizen's ideas. The public took the NBS to their hearts and also saw the added value in having small intermittent streams and lakes in their green areas.

Dr. Elisabeth Ruijgrok, Public Goods Economist, Witteveen+Bos, the Netherlands, shared her experience of how the ecosystem valuation of ecosystem services can help to get nature-based solutions, instead of technical solutions with the case of the development of Belgian National Flood safety plan, so-called Sigma Plan Scheldt estuary. In fact, this is one of the first building with nature cases, dating back to the 2004. It became the basis for now called the NBS from theory to practice in both the Netherlands, and in Belgium.

At that time, the key question was whether Belgian should choose the NBS or technical solution, including whether flood safety through dike heightening or through natural inundation areas. Traditional dyke heightening is cheaper than the creation of inundation areas, but inundation areas provide ecosystem benefits.

The key for encouraging the adoption of the NBS was to show the quantitative analysis of ecosystem service and all ecosystem benefits quickly. As the calculation methodology, the TEEB (the economics of ecosystems and biodiversity) methodology was used, although that name did not exist yet in 2004. Her research team looked at the various ways in which different types of ecosystems (mudflats, reed lands, forest, grassland) generate human welfare/wellbeing. Each ecosystem benefit (either good or service) is calculated by multiplying a quantity (Q) with a price tag (p), e.g. amount of carbon fixation per year times price per ton carbon; number of recreational visits per year times price per visit, when creating a new wetland. This study turned out to be self-convincing for the Belgian government that they decided to choose the natural solution instead of the technical solution.

In conclusion, she emphasized the provision of cost-benefits analysis and the highlight of ecosystem benefits and the benefits of natural solution in timely manner fitting to the speed of political decision-making process is the key for the adoption. The solution is applicable, where there is demand for recreation, a need to achieve biodiversity and water quality goals, potential for livestock co-use.

Dr. Anna Tengberg, Programme Manager, Swedish Water House (SWH), adjunct professor at Lund University Centre for Sustainability Studies, shared the case from the western region of Sweden on NBS for flood risk management in agricultural and urban areas. The flood prone area downstream of Lake Vänern in the County of Västra Götaland, Sweden, has been testing different categories of NBS measures to reduce flood risk in the face of climate change. Measures such as soil management, riverbank buffer strips and plantation of trees for infiltration and slowing of water flows have proven to be effective, cost-effective and popular with land users, as well as carbon sequestration, and recreation value. The strong local level participation and engagement of the landowners as well as high level policy and financial support also assists the implementation.

She also introduced Sweden's project experiences on NBS for water to the application of the Nationally Determined Contributions of the UNFCCC. In its development cooperation, Sweden is supporting agroforestry for the NBS, as it helps farmers to adapt to extreme and variable weather, while is also contributing to mitigation of climate change. The synergies have been generated in afforestation and reforestation, groundwater conservation, etc. Because of its multiple benefits for the climate agroforestry is included in many NDCs. The Enabling environment is local-level participation and bottom-up approaches coupled with market access as well as higher-level policy and financial support.

Prof. Takashi Asaeda, Emeritus Professor, Saitama University, Japan introduced the Japan's historical nature-based way of flood control management "Kasumi-Tei". He then explained how these has been changed over the time with grey engineering-oriented methods. He then emphasized the new lessons for the necessity of the perception change to deal with flood risk management under changing climate and increasing numbers of extreme events.

Prof. Asaeda explained, in natural system along the river channel is that, originally, there is no strong dikes, except for the natural levees and floodplain behind. Flood water frequently overflows the levees and inundates widely in the flood plain. It becomes disturbances for the flora and fauna, and is most essential events in the river ecosystem. The recent flood control system is, however, based on the construction of strong continuous dikes, excluding water invasion into the residential zone behind the dike.

In Japan flood control management, discontinuous dikes were traditionally constructed, with which flood water flew though the open space into behind the dike, and inundated even at small floods, then withdrew in the river channel again if the water level declines. As the flood period is not long, it does not affect agriculture and daily lives, and suits to create health ecosystem there. People's life-style was flood oriented, maintain a high spot in the area and equipping a small boat. This type of flood control system is consistent with the natural levee – flood plain system.

Under recent the increasing thread of global warming, storm level is rising. It is difficult to construct a sufficiently strong continuous dikes for any flood event. Introduction of the concept of natural levees and discontinuous dikes are particularly required. However, in the area once strong dikes were constructed, flood experience was forgotten from the local people mind. It is hard to return to the previous style.

Prof. Lee-Hyung Kim, Civil and Environment Engineering Dept. Kongiu National University, Republic of Korea, introduced the application of various scales' low impact development (LID)[1] to address surface and sub-surface's natural water cycle and inundation prevention in urban areas, including the application for green infrastructure for LID. He showed the outcomes of quantitative analysis about the efficiency of each LID facilities, such as pollutant removal efficiency, runoff reduction efficiency, as well as the level of green water recharge by the application of LID. He also shared the quantitative analysis of the monetary benefits of LID application in terms of water quality, CO_2 reduction, heat islands reduction, landscape, and air

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[1] systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater to protect water quality and associated aquatic habitat.

quality.

In Republic of Korea. the NBS with the LID to cope with the risk of inundation is used to diversify the techniques, decentralize facilities, and Integrated watershed management between technological approaches and Nature-based Solutions (NBS) and Integrated Watershed Management for Water Security. It is also applied for the Water-wise cities with LID and Green infrastructure, water reuse with decentralized water management system, and protection of water resources in agricultural areas. The factors for consideration is water resources, water environment, water safety, water ecology as well as the functions and nature and water cycling mechanisms.

Panel Discussion & Conclusion

In the panel discussion, Mr. Ravi Narayanan moderated the discussion in relation with the presentation of each speaker. The speakers specifically discussed the challenges and opportunities to address NBSs within a crowded environment, such as urban areas, since they typically require large surfaces of land and space. Following the core question, the panelists also discussed:

- ✓ how to enhance incentives to implement NBS in these areas,
- ✓ whether and how we need to change the overall systems as a number of substantial catastrophes have happened frequently, and how to deal with the trade-offs between upstream and downstream,
- ✓ what methodology can be used to calculate environmental and ecological benefits and costs, and how these can be effectively used for communication with multi-stakeholders in order to move forward.

In conclusion, the lessons from the cases that speakers brought to us re-confirm the necessity to think through all the effects carefully, namely, the different effects over time on the ground, even for NBSs that have been successfully implemented elsewhere. The key for the application of NBS is how we can demonstrate the co-benefits and how we can communicate them well using quantitative analysis. It involves understanding the co-benefits and how the trade-offs among the different stakeholders and across different values were dealt with. With the case of the Netherlands for instance, we found out that pricing is not the key problem in determining ecosystem benefits in practice. The key is the quantification of the socio-economic value and the identification of an appropriate price tag for each ecosystem function. In addition, it is also critical to determine how to best use these outcomes for communicating with multi-stakeholders to obtain optimal win-win solutions. It is necessary to adopt an NBS design from which everyone can gain benefits. Some compensations and support to the landowners and people downstream are also needed to deal with several conflicts of interests.

Through the cases presented by 5 speakers, we were able to see two issues pertaining to the application of NBS, namely:

1. Making the case requires a clear economic and social analysis.
2. Making it happen on the ground requires good communication skills and partnerships since several parties will be involved.

The question remains, what happens when we apply NBS in very densely populated areas?

2 recommendations (e.g. policy/call-to-actions)

DWF:

Create local groups, including utility people, local citizens and other stakeholders from the early start. Accept that a NBS can be more expensive than traditional solution, but it might add value.

Dr. Anna Tengberg, Programme Manager, Swedish Water House (SWH)

Successful implementation of NBS requires a supportive enabling environment that combines local-level participation with high-level policy and financial support.

Prof. Takashi Asaeda, Professor Emeritus, Saitama University, Japan

1. The main obstacles in defining NBS are the limitation of space, especially privately owned land and involvement of diverse stakeholders related to land. Various disciplines are required such as land use planning, legacy, social issue, landscape architecture, ecology, agriculture, hydrology, NGOs involvement and property rights etc.
2. Resettlement plan should be implemented to address the land pooling. Also, some treatments, such as compensation, etc. is required to solve the land issue. The experts related to different disciplines should give efforts to overcome the respective issues.

2 initiatives, tools or networks that support the learning objectives or that have fostered the goals of your session

DWF:

Put signs and explanations on writing out next to the NBS so people can see and learn

Dr. Anna Tengberg, Programme Manager, Swedish Water House (SWH)

The Agroforestry Network coordinated by Vi-Skogen is promoting agroforestry in Africa, while the testing of NBS measures in western Sweden is part of an EU-supported programme in Europe.

Prof. Takashi Asaeda, Professor Emeritus, Saitama University, Japan

1. In recently amended Arakawa Upstream River Improvement Plan, the concept of the overflow allowing dikes were introduced after a long discussion. It will be a first step as a governmental management.
2. There are many literatures, old stories, legends, regarding on the traditional Japanese flood control system. Constructed dikes still remain locally. They are very instructive.

Outcomes of the session

The number of participants: 259 people registered, and 158 people actually joined this session. During the webinar, we received a number of questions from the audience.

The presentation documents, etc, are available at:

https://www.worldwaterweek.org/event/9170-co-benefits-of-implementing-nbs-for-climate-related-water-and-flood-management

the session recording on YouTube is available at:

https://youtu.be/6GUNUvWLkgI

The Next Phase of NoWNET

The next phase of NoWNET aims to produce case studies on the ways to promote NBS for crowded areas, such as in over-populated urban areas, with an analysis of what works and where, and under what conditions the NBS failed.

Responses to the Questions from the Audience

Interaction with audience through Q&A was implemented during and after the webinar.

For all panelists:

Q1: What was the biggest obstacle to be overcome in defining the NbS? Was it legal, technical, financial or social?

(Answer from DWF): The biggest obstacle was to convince citizens that moving from traditional underground concrete solutions towards on-ground NBS would definitely add value to the landscape in many sub-urban areas. For the citizens in densely populated areas it was the understanding that their curb-side and their small parks would be flooded maybe 1-2 per year, but of cause at the same time, extensive downpour would anyway turn the city into a puddle of water, since the underground systems would not be able to cope with the amount of storm water. It also took some time to understand that the changes in climate-related growing events of heavy downpour would increase the costs substantially, if all new solutions should be under-ground solutions and that surface-solutions would be cheaper and eventually everyday-greener.

(Answer from Dr. Elisabeth Ruijgrok, Witteveen en Bos)

The biggest challenge was to ensure that the NbS has the same flood protection benefits i.e. the same flood risk reduction, as the competing traditional/technical alternatives of dyke heightening or a storm flood barrier.

(Answer from Prof. Takashi Asaeda, Professor Emeritus, Saitama University, Japan)

The main obstacles in defining NBS are the limitation of space, especially privately owned land and involvement of diverse stakeholders related to land. There are different challenges related to varied disciplines such as land use planning, legacy, social issue, landscape architecture, ecology, agriculture, hydrology, NGOs involvement and property rights etc.

In the natural system, wide area is inundated during flood event. Thus, to introduce NBS to the flood control management, there must be strong obstruction of residence. Resettlement plan should be implemented to address the land pooling. Also, some treatments, such as compensation, etc. is required to solve the land issue. The experts related to different disciplines should give efforts to overcome the respective issues.

Q2. Nature-based solutions do not seem to have a great track record of benefiting the poor. In fact, because of weaknesses in land tenure rights and governance more widely, they can

end up being shut out from decision making, or worse, shut out form the land they have stewarded sustainably for centuries. what is your reflection to that and what needs to be done to have inclusive and sustainable NBS in place?

(Answer from DWF)

It is of utmost importance to ensure that use of farmland as part of a NBS will cause impacts in the landowners possibilities to use her land optimally, so some kind of either one-time financial compensation or annual compensations mut be paid out to the landowner. It is also important to highlight that the NBS is in fact helping people "downstream", so the landowner understands and gets credits for providing land for the solution.

(Answer from Dr. Elisabeth Ruijgrok, Witteveen en Bos)

I think, even countries where the opposite is happening (i.e. losers are not put aside, but losers with small losses stop the project!), we should always try to do stakeholder inclusive designs: I call this benefit oriented design, a design that has more benefits for more groups of people e.g. by adding co-use. If your NbS can do that, it will be a success

(Answer from Prof. Takashi Asaeda, Professor Emeritus, Saitama University, Japan)

The challenges that are associated with the nature-based solutions are technical, legacy, financial, social, hydrology, ecology and property rights. A joint team expert related to different disciplines are needed for high level planning, such as land use planning, etc., decision making and implementing of the tasks for targeted output, which is firstly required in the political level, not just for a target area, only. The involvement of diverse nature of stakeholders is also important to address sustainable NBS. The involved diverse stakeholders should be clearly understanding about objectives of the NBS project and should also know about the end users of the project. The sustainability of NBS can increase by using ecosystem base adaptation known as "GREEN INFRASTRUCTURE" rather than "HARD ENGINEERING" known as "GRAY INFRASTRUCTURE".

Question to individual speaker:

(Q to Dr. Elisabeth Ruijgrok, Public Goods Economist, Witteveen+Bos, the Netherlands)

Q3 What was the methodology applied to calculate the environmental/ecological values/benefits ?

Answer from Dr. Elisabeth Ruijgrok, Public Goods Economist, Witteveen+Bos, the Netherlands

The TEEB (the economics of ecosystems and biodiversity) methodology was used, although that name did not exist yet in 2004. This means that we looked at the various ways in which different types of ecosystems (mudflats, reed lands, forest, grassland) generate human welfare/wellbeing, such as:

- Carbon burial by mudflats, leading to climate protection benefits;
- Sediment fixation by mudflats, leading to less dredging costs of shipping lanes;
- Recreational opportunities of wetlands (i.e. combination of mudflats, reedland etc) leading to recreational enjoyment benefits;
- Aeration of water by tidal gullies, leading to more fish and thus sport fishing benefits and fish harvest benefits;
- Etc.

For the quantification of the benefits we used modeling and surveys, for example:

- How much carbon does a mudflat bury per year? The omega model (for C, N and P) was used for that.
- How many recreationists will visit the wetland? A survey was used to determine this.

For the monetarization we used price tags, for example:

- For carbon (i.e. climate protection benefits) we used a readily available carbon price reflecting climate change damage of 1 ton CO2;
- For recreation (i.e. enjoyment benefits) we used a willingness to pay per visit derived from a survey.

(Q to Dr. Elisabeth Ruijgrok, Public Goods Economist, Witteveen+Bos, the Netherlands)
Q4 How will you evaluate losses. What value will be attributed?

Answer from Dr. Elisabeth Ruijgrok, Public Goods Economist, Witteveen+Bos, the Netherlands
There were two negative "benefits" i.e. negative impacts (not to be confused with costs, as the term "costs" is reserved for the costs of creating the nature-based solution):

- The loss of recreational fish fonds; this was calculated by multiplying the visits per year times a price tag per visit based on fishing license price.
- The loss of view for houses that were near the new ring dyke: this was calculated by counting the houses and multiplying with a % of value loss.

(Q to Dr. Anna, Programme Manager, Swedish Water House (SWH))
Q5 What NDCs did you analyze, mainly from Sweden or also from other countries?

Answer from Dr. Anna, Programme Manager, Swedish Water House (SWH)

We did a synthesis of different reviews of (I)NDCs, including by UNFCCC, GWP, IUCN, FAO, USAID, WWF, the Nordic Council of Ministers, FWP and Coalition Eau

(Q to Dr. Anna, Programme Manager, Swedish Water House (SWH))
Q6 NBS can be derived from traditional knowledge as well. Did the case studies take these into consideration?

Answer from Dr. Anna, Programme Manager, Swedish Water House (SWH)
Yes, agroforestry systems are often based on traditional knowledge. Also many other NBS build on traditional knowledge, even in Sweden.

(Q to Prof Asaeda)
Q7: In the retention /detention basin has the aquifer groundwater also been incorporated as part of design to hold on temporarily to storm water?

(Answer from Prof. Takashi Asaeda, Professor Emeritus, Saitama University, Japan)
The volume of aquifer groundwater is extremely lower than the space available in retention basin. As the volume flux and the exchange with the flood water is extremely small compared to the flood water flux, the aquifer groundwater contribution assumed as negligible. The factor of safety (FOS) in design of dikes considered the high flood level which can also hold the aquifer groundwater. Also, the availability of water discharge in aquifer shows seasonal variation in a year. The water discharge in aquifer is lower during winter and pre-monsoon seasons and increases in monsoon and post-monsoon seasons. Considering seasonal fluctuation of water discharge in aquifer, only some selected months showed comparatively high amount of water with respect to dry months. So, due to its negligible volume, we do not need to consider it at all.

(Q to Prof. Takashi Asaeda, Professor Emeritus, Saitama University, Japan)
Q8: Are NBS proven to be as effective in addressing water stress, as they seem to be in addressing flooding and other excessive water issues?

(Answer from Prof. Takashi Asaeda, Professor Emeritus, Saitama University, Japan)
Nature has power of preserving the integrity and intrinsic value of aquatic and terrestrial ecosystem. The balancing phenomenon in nature has deteriorate by the anthropogenic activities such as dike construction, dam construction etc. The nature-based solution (NBS) are the actions inspired, supported, copied and guided from the nature to cope environmental, social and

economic challenges in sustainable ways. It makes use of natural processes and ecosystem services for functional purposes. The natural water flows its natural path during normal time events and overflooded only during flood events. The flooded water with nutrients is the key sources of balancing the riverine ecosystem. To balance natural environment and to protect human lives and properties, NBS should be adopted. Nature based solution (NBS) in this case is that the dikes allow overflow in flood plain behind the dikes, which is similar to the natural levee. The power of water during flood events is distributed over a large territory behind the dikes. For example: dikes planted with vegetation and deep-rooted trees decrease the bed shear stress of flow and decrease erosivity of water. NBS based dikes does not increase the inundation depth during flood events, and floodplain keeps water for a long time after flooding. The water depth after flood events behind the dikes is small and only exist in countable during flood season. Thus, it is extremely effective, economical and sustainable water management tool for decreasing flood risk.

(Q to Prof. Takashi Asaeda, Professor Emeritus, Saitama University, Japan)
Q9: In what situation, do you think, are discontinuous dikes more suitable than continuous ones?

(Answer from Prof. Takashi Asaeda, Professor Emeritus, Saitama University, Japan)
As long as the flood level is lower than designed maximum flood level of the dike height, continuous dike can prevent the flood water to the overflow the dike, and works efficiently. However, if the flood water level exceeds the dike height, flood water overflows the dike to the outside area and inundates the area deep.

With discontinuous dikes, on the other and, though flood water frequently spreads outside widely even at low flood level, thus flood water level does not rise high and the inundation depth of the side area is kept as low. Therefore, it works well particularly at a large flood.

The following points elaborate the situation that shows the discontinuous dikes are more suitable than continuous dikes. The main considering points described here are factor of safety (FOS), catchment area size and number of tributaries, available space and aesthetic appearance.

- Continuous dikes are suitable for a continuous river length having low discharge whereas discontinuous dikes are preferable for intermittent connection of tributaries to hold maximum flood of the catchment.
- Subjected to connected upstream tributaries of a catchment to the main channel increases, the discharge increases in the downstream, so that increasing height of dikes is required in the downstream to maintain the safety factor, which is

uneconomical. To overcome this effect, intermittent regulated outlet should be installed for safe passage of flood water during emergency. Example: Arakawa dikes. This installation makes the dikes discontinuous.

- For structurally safe design, discontinuous dikes should be better. Discontinuous dikes are not expected to fully water shield.
- Repair and maintenance works are easy in discontinuous dikes.
- In case of breaching of continuous dikes during extreme flood events, it will create tremendous loss of lives and properties. The affected area could be higher than breaching of discontinuous dikes.
- For maintaining FOS (factor of safety), the design of large height and bulky size of continuous dikes cover wide space than discontinuous dikes. This is very unavoidable scenario in the case of high priced land value like in Tokyo. Also, the construction of bulky structure makes the residential area in shadow behind the continuous dikes, that create more vulnerable situation, for instance: always risk from higher flood, unaesthetically appearance, sunshine inhibition, etc.

Mentioning above description supports situation for discontinuous dikes are suitable than continuous dikes.

About NoWNET

NoWNET is a network of country level water partnerships in Europe, Japan and the Republic of Korea for exchanging experiences and good practices to address water challenges, interacting with multi-stakeholders. It was initiated by the World Water Council (WWC), Global Water Partnership (WWC), and the Steering Committee of the 3rd World Water Forum held in Japan in 2003.

NoWNET members (11 organizations): -

- GWP
- WWC
- Danish Water Forum (DWF)
- Finnish Water Forum (FWF)
- French Water Partnership (FWP)
- Japan Water Forum (JWF)
- Korea Water Forum (KWF)
- Netherlands Water Partnership (NWP)
- Portuguese Water Partnership (PWP)
- Swedish Water House (SWH)
- Swiss Water Partnership (SWP).

JWF has maintained a role as the secretariat ever since its launch.

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