Nature and Climate Nexus: Promoting Nature-based Solutions for Sustainable Infrastructures in Asia and the Pacific

# NATURE-BASED SOLUTIONS FOR CLIMATE DISASTER RISK MANAGEMENT

(LECTURE PROCEEDINGS)

September 2022


For more information, and access to the event materials, please visit Development Asia (DevAsia) ADB Knowledge Events page: Nature-based Solutions for Climate Disaster Risk Management.

DevAsia is ADB's knowledge collaboration platform for sharing development experience and expertise, best practice, and technology relevant to the Sustainable Development Goals. DevAsia also provide opportunities to interact with experts, policy makers, and other practitioners in related fields. It aims to share development knowledge generated from ADB events with the international development community and the public.

## Table of Contents

## The Partnership

Asian Development Bank (ADB) was conceived in the early 1960s as a financial institution that would be Asian in character and foster economic growth and cooperation in one of the poorest regions in the world. ADB assists its members and partners by providing loans, technical assistance, grants, and equity investments to promote social and economic development. ADB is composed of 68 members, 49 of which are from the Asia and Pacific region. ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty.

The Netherlands Enterprise Agency (RVO) helps entrepreneurs and organizations to invest, develop, and expand their businesses and projects both in the Netherlands and abroad. It is a government agency that carries out the Dutch Ministry of Economic Affairs and Climate policy. RVO helps entrepreneurs, Nongovernment Organizations (NGOs), knowledge institutes, policymakers, and organizations. It supports entrepreneurship, improve collaborations, and strengthen positions through their funding and networks. By sharing their knowhow, RVO helps its clients move forward doing business abroad.

**ADB**

Qingfeng Zhang, Chief of Rural Development and Food Security (Agriculture) Thematic Group and Officer-in-Charge, Environment Thematic Group, Sustainable Development and Climate Change Department (SDCC)

Isao Endo, Environment Specialist

Victor Tumilba, Consultant

Lourdes Margarita A. Caballero, Consultant

Cecille P. Villena, Consultant

Christine C. Linaza, Consultant

Marianne Villanueva, Consultant

Lucy Ignacio, Consultant

**RVO**

Lejla Vandić, Programme Coordinator

# I. Introduction

Nature-based solutions (NbS) can help address challenges in climate change, disaster risk management, water security, biodiversity loss, and food security. These solutions protect, sustainably manage, and restore natural or modified ecosystems. NbS also address societal challenges effectively and adaptively, simultaneously benefiting people and nature (IUCN). NbS provide practical and cost-effective approaches for long-term sustainable infrastructure in a changing climate when integrated into traditional construction methods. Furthermore, NbS offer multiple advantages such as reduce project costs and prolong infrastructure lifespan. NbS also provide co-benefits to ecosystem services, biodiversity conservation, recreational opportunities, employment, and livelihoods.

Applying NbS requires integrated planning and management that are evidence-based and for long-term sustainability. It must be guided by international, national, and local policy frameworks to reach its full potential. Despite the increasing recognition of NbS, there is still a need to provide practical knowledge on its implementation. These factors are just a few that hinder designing and implementing NbS.

To address this knowledge gap, ADB is hosting the Nature and Climate Nexus Webinar Series: Promoting Nature-Based Solutions for Sustainable Infrastructures in Asia and the Pacific. This webinar series share the latest information and benefits from using NbS. The events also highlight the integration of NbS into investments for sustainability and resiliency. The webinars will feature lectures, trainings, and workshops based on the latest scientific knowledge, case studies and best practices on NbS for infrastructure projects. This webinar series is organized by ADB's Environment Thematic Group (ETG) in collaboration with other Sector and Thematic Groups as well as private, government and academic partners.

To kick off, ADB and the Netherlands Enterprise Agency (RVO) conducted the first webinar of the series on Nature-based Solutions for Climate Disaster Risk Management composed of both lecture (15 September 2022) and clinic (21 September 2022) sessions. The ADB's Environment Thematic Group, Water Sector Group, Urban Sector Group, and Climate Change and Disaster Risk Management Thematic Group co-organized this NbS lecture and clinic which is also part of the activities of the NbS Working Group.

# II. Objectives

The NbS for Climate Disaster Risk Management Lecture (see Appendix 1: Program) and Clinic aimed to mainstream NbS into ADB operations by raising awareness and strengthening the capacity of its project officers. The activity had the following objectives:

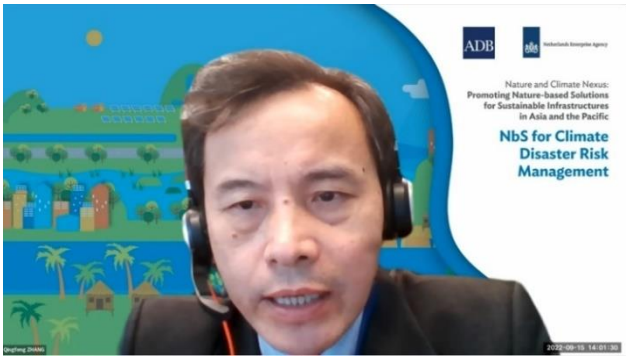
1. Share NbS case studies and good practices in water-related investments;
2. Discuss how NbS tools can be used in flood and drought risk management; and
3. Improve project design skills using NbS and gray infrastructure on actual ADB pipeline projects.

The well-attended NbS Lecture brought together 174 participants from 31 countries including ADB's developing member countries (DMCs) such as Bangladesh, Cambodia, Georgia, India, Indonesia, Myanmar, Nepal, Pakistan, Papua New Guinea, People's Republic of China (PRC), the Philippines, Thailand, and Viet Nam. The NbS Clinic was a closed session for ADB staff and consultant, and 25 participants joined. The summary of feedback from participants on the lecture session can be found on Appendix 2.

# III. Nature-based Solutions for Climate Disaster Risk Management

**NbS Lecture Session (15 September 2022)**

### *Opening Address*




The Chief of the Rural Development and Food Security (Agriculture) Thematic Group and Officer-in-Charge of the ETG, Qingfeng Zhang, highlighted that several DMCs have been hit by severe weather events (such as floods) as well as earthquakes in the past few years. These events are also worsening with alarming frequency. Given this scenario, it is even more important now to build resilience and help vulnerable communities. NbS are good options since these integrate natural features or processes into the built environment to promote adaptation and resilience.

NbS are also often of higher-quality and lower-cost, more resilient, and more beneficial to society than purely gray infrastructure solutions. Therefore, NbS can help DMCs meet the infrastructure investment gap in a cost-effective manner while producing substantial social, economic, and environmental co-benefits. Combining gray infrastructure and NbS, often referred to as a hybrid approach, can also provide a favorable avenue for rethinking and remodeling our DMCs' infrastructure.

### *NbS for Flood and Drought Risk Management Lecture*


Bregje van Wesenbeeck, Scientific Director of Deltares, gave an overview of NbS which are actions to protect, sustainably manage, and restore natural and modified ecosystems. NbS can also be used to complement infrastructure projects. In simple terms, NbS means using nature in infrastructure design for functional purposes.

NbS became more popular in 2005 when the Millennium Ecosystem introduced the term 'ecosystem services' which recognized that ecosystems deliver services that benefit humans and can help adapt to climate change. For example, nature can buffer waves and reduce currents, save water in times of flood, and release water during drought. The environment can also help sustain offshore fisheries, help with tourism, and bring economic gains. These are just some of the functions of nature that can help us sustain through climate change and other crises.

For harnessing the benefits from nature, the Natural River Management (NRM) concept for integrating NbS investment options into project design was presented. NRM is low interference management of rivers. It aims to optimize river use and reduce river related risks such as flood and soil erosion. This is done while respecting natural dynamics and flow of fresh water and sediments. It also considers people's inter-dependence on rivers at a basin scale. For instance, an upstream project can impact the life of communities far away downstream.

**Importance of Natural River Management**

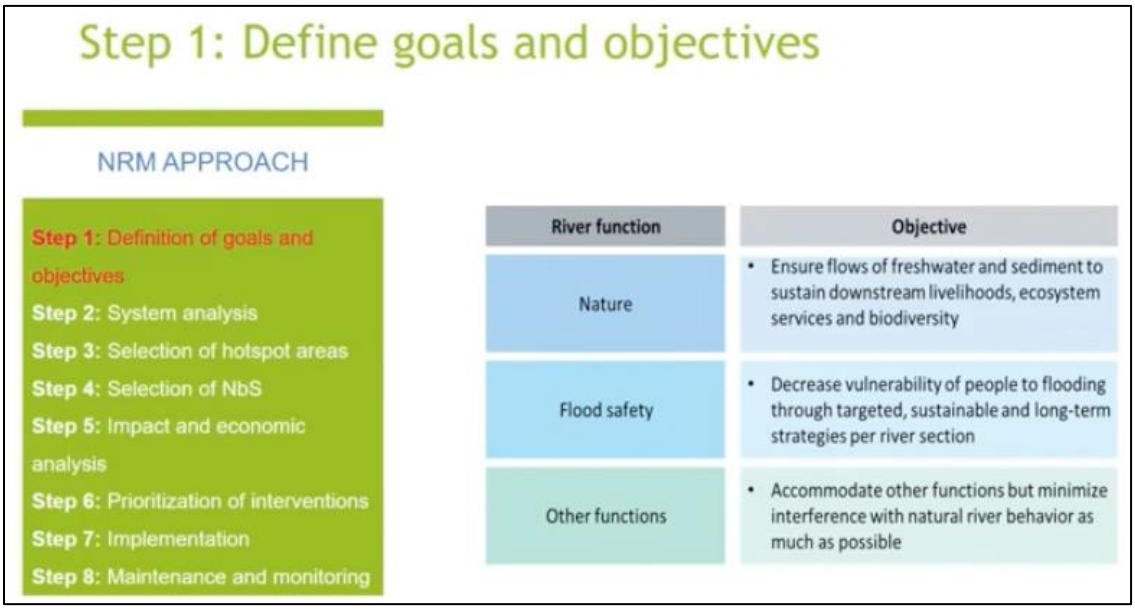
As a case study, the LA river (USA) exemplified how reducing space for the river by restricting the river through concrete culverts, b increases droughts, as the effect was less water infiltration into the soil and neighboring areas. In many cases where people try to control or manage rivers, unforeseen effects emerged. In addition, climate change introduces effects that are not expected.

In the Rhine River in Europe, the middle section of a complex braiding system was changed to a single channel. The change was done to improve conditions for navigation, but the long-term results were stronger and more dangerous currents, when erosion till bed rock occurred. This made navigation more difficult. New side channels were made to combat these issues, but this caused lowering water tables in upstream agricultural areas. To mitigate these effects, upstream retention areas were installed. Germany is still struggling with the effects of earlier interventions, which comes at considerable cost.

Given both examples above, managing rivers for a single purpose often results in adverse effects that require additional mitigation measures. Hence, respecting the natural river condition in its management is key.

Ecosystems are not always easy to work with and it is important to understand the natural system in applying NRM and NbS. One must know how nature works and bring in a team as early as possible to help assess how the infrastructure works and improve the odds of success for a healthier ecosystem and in developing sustainable projects.

There are eight key steps to NRM for integrating NbS which fits ADB's project cycle and operations:




- **Step 1: Define goals and objectives.** Look into the big picture. Consider all stakeholders and not just one aspect. Make sure to define multiple objectives. It is challenging to define goals since interests are conflicting, such as issues on navigation and desired water levels.
- **Step 2: System analysis.** Divide the river into three parts – upper, middle, and lower course. Each one has its own challenges as different processes are at play. Consider these characteristics since they are crucial.

**Step 3: Selection of hotspots**. This is basically doing risk assessment. However, keep the people and the community central in this. Use it to look for areas to focus on, for instance, areas where people are exposed to flooding.

- **Step 4: Choosing NbS options**. There are many options available and they are listed on the Guidelines for Mainstreaming Natural River Management in Water Sector Investments. It is best to use natural solutions first and combine them with infrastructure solutions if needed. Examine the full portfolio and see how it can be used in a coherent and symbiotic manner.
- **Steps 5 and 6: Intervention Selection and Cost-Benefit Analysis**
    - Look at the economic analysis that considers multiple benefits from nature which could help in choosing which measures or interventions to implement. Take a wider perspective of the situation and consider the upstream and downstream effects of the measures.
    - It is also important to consider the perspective of a longer period. Look at the return on investment in 30 to 50 years as it tends to be more positive. The effects of NbS usually takes longer and some are even more sustainable over time.
    - Look beyond economic cost analysis as it is important to assess the additional benefits that nature provides.
- **Step 7: Implementation.** This involves design, construction, and building measures. Natural areas and functions may already on site but sometimes at an unhealthy or deteriorated state. This means these natural areas and functions need to be restored, conserved, and maintained.
- **Step 8: Manage, maintain, and monitor.** Maintenance and monitoring are difficult for financing institutes. There is often financing for implementation of projects but not for maintenance. Take caution before stepping into hard infrastructure without a maintenance budget. Infrastructure will fail at some point and will need maintenance. Infrastructure must also be monitored for users to know when to conduct predictive or preventive maintenance.

The key takeaways from this lecture are the following:

- NbS can be applied in all settings for all types of hazards. This however requires help from local experts and ecologists in order to be effectively planned and implemented.
- Pro-actively identify NbS and hard infrastructure synergies.
- Prepare to learn and adapt in applying NbS.

### *Building with Nature Lecture*


Tom Wilms, Project Manager of Witteveen+Bos, reiterated in his lecture that applying NbS should consider various processes of different natural, socio-economic and institutional. One must have a good understanding of these processes to avoid failures. NbS also have many benefits by capitalizing on the natural processes and functions of nature instead of fighting against it. However, implementers must look beyond how NbS solves the problem. Sometimes, good NbS depend on the available space and integration of conventional systems with new measures becomes a necessity.

In the Netherlands, NbS started in 2008 with EcoShape Building with Nature. There is the realization in the last 15 years that there is paradigm shift where people should think, act, and interact differently:

- **Think differently.** Man-made projects are an inherent part of the environment, so they have a chance to make a positive change and impact.
- **Act differently.** Natural processes can be used and stimulated to reach an optimal and sustainable solution with infrastructure projects.
- **Interact differently.** Projects can only be successful through collaboration. Stakeholders should be involved as early as possible. In addition, stakeholders can have a valuable role in monitoring and maintenance.

There are also six types of enablers needed to bring projects forward, especially those including NbS in implementation:

1. **Technology and system knowledge.** It is vital to understand the technology and system to be used.
2. **Multistakeholder approach.** Do not do it alone. Build coalitions and co-create shared ambitions.
3. **Adaptive management, maintenance, and monitoring.** The world is dynamic, and we do not know everything, hence it is best to adapt. It is also vital to make maintenance strategies a part of the development process.
4. **Institutional embedding.** This relates to the rules and regulations. When it is possible to adjust them to make NbS easier. NbS might not fit within the existing context, norms, and regulations. It is important to develop an environment that allows conservation laws and formal instruments to be addressed. It is also advisable to connect with international groups that enable policies.
5. **Business case.** Define an optimum business model. Improve maintenance cost estimates and additional services and benefits. Make financial arrangements early on, e.g., through tourism or aquaculture.
6. **Capacity building.** It is vital that local organizations learn too. Increase their awareness of the benefits of Nature-based Solutions. Involve the younger generation and create communities around the project to generate more engagement.

The key takeaways from this lecture in implementing good NbS are the following:

1. Use all processes: natural (e.g., biological, and hydraulic), social, economic and even institutional.
2. Require good understanding of all these processes. Without this knowledge, the solutions have higher risks of failure.
3. NbS have many benefits as they use natural processes instead of working against them.
4. NbS are good solutions in many situations depending on the available space.
5. NbS result in a mix and integration of measures that are both conventional (hard, gray) and new (soft. Green).
6. NbS are not green washing and not only the construction of nature areas.

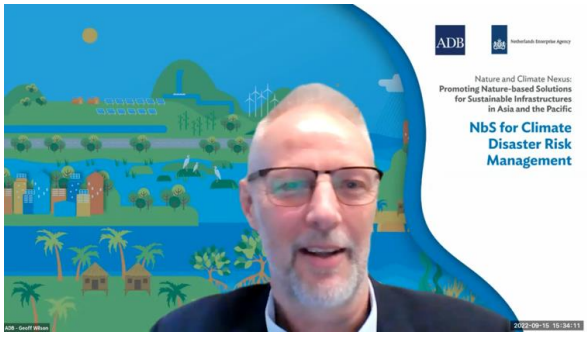
### *Panel Discussion*

The discussion was hosted by Charles Rodgers, Senior Advisor for Climate Change Adaptation, ADB. The panelists were the two lecturers, (Bregje van Wesenbeeck and Tom Wilms) and two ADB staff, Geoffrey Wilson, Senior Water Resources Specialist, Water Sector Group and Stefan Rau, Senior Urban Development Specialist, East Asia Regional Department. The panel addressed three major questions:


1. What do you see as the strategic opportunities or implications of NbS for ADB and specifically in your sectors and projects?
2. What are the greatest challenges we are likely to face in introducing and integrating NbS in our investment projects?
3. What type(s) of information would be most valuable to you to support and/or enable NbS?

The discussion on the questions from participants are presented in Appendix 3.

***Question # 1: What do you see as the strategic opportunities or implications of NbS for ADB and specifically in your sectors and projects?***




Geoffrey Wilson highlighted that strategic opportunities lie in addressing water availability and quality issues and managing water-related disaster risks such as floods, droughts. Water management is still dominated by grey infrastructure and NbS remains underused. However, NbS has the potential to address issues like water management challenges and sustainable agriculture. This can help improve food and water security as well as manage flood risks. NbS also has the potential to create livable cities and provide decent work, and even support a circular economy, which aims to reduce reuse and recycle waste.

There are three relevant opportunities. One is to achieve ADB's agenda for 2030. This is crucial for ADB's agenda on prosperity, inclusion, and financial based solutions. Second, there is the opportunity to contribute to the Paris Alignment and Climate Financing since NbS is an adaptation measure against climate change. Thirdly, it is critical to take advantage of media exposure such as the recent major flood disaster in Pakistan as an example. Many rivers in Pakistan are channelized which is contrary to the NRM and NbS principles and should be re- assessed. ADB is now engaged with the Government of Pakistan to address this issue.

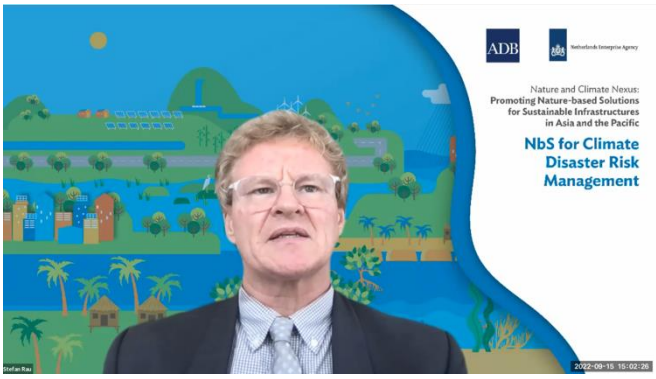
Stefan Rau shared that building green capital is a strategic opportunity that will also have big impact on the urban sector. Well-designed parks and other green spaces can help with the hydraulic and climate functions as well as natural ventilation. Green spaces serve its main purpose of being a public park that provides many benefits to residents as well as increase land value. There is also a good opportunity for upstream urban planning in areas where urbanization is happening rapidly. The challenge, however, is that urban areas often do not have enough space to implement NbS. There is a greater chance integrating

green and grey infrastructure by starting with risk-based informed urban planning. This starts by planning green spaces first where infrastructures will not be built such as wetlands and flood plains. Climate relevance of these spaces and the values of the ecosystem should also be analyzed.

There is also enormous potential to involve the private and public sectors. Cities have public spaces such as parks and roads and private landowners can also contribute to NbS and resilience. NbS in urban areas also provides major educational opportunities where everyone can learn from green spaces. The environment also becomes more pleasant to look at and be in aside from creating good urban microclimate which contributes to one's health and well-being. Thus, green spaces and parks are valuable urban assets.

Bregje van Wesenbeeck highlighted that NbS will change the initial stages of a project. It will also change and how one would assess and conduct feasibility studies to access the opportunities mentioned for the water and urban sectors. As per experience with several government projects, more attention is given to the first phase of the projects with NbS. Conducting proper feasibility studies results to better projects that are more sustainable and robust. Tom Wilms corroborated these statements. It is also valuable to be aware that projects in their early phase often have only one stated primary goal. This puts environment and society a step or two behind the primary goal, making co-benefits from these aspects seemingly less important. It is thus important to place the environment and society at the level of the project goal and include these co-benefits.

***Question #2: Based on your experience and the experiences of peers and colleagues, what are the greatest challenges we are likely to face in introducing and integrating NbS in our investment projects?***




Stefan Rau shared that there are still hurdles in applying NbS in ADB projects and urban planning. There is the need to change mindsets – ours as well as colleagues, the people in the field as well as politicians. There is a systemic inertia that we need to overcome. Education should be changed as engineers are still taught to focus on grey infrastructure systems. Engineering handbooks are also still based on traditional infrastructure systems. The building standards and procurement practices are all used to the old ways. These all must be changed. To change people's mindsets, we need more proof of concept of NbS. As NbS has already been proven in theory, now we need more proof in practice. We should work on simulations with smart systems such as hydrological and hydraulic modelling for flood and drought risk management. This should be coupled with demonstration projects to showcase how NbS works and interact with experts on ground.

Economic analysis is still challenging, especially when it comes to acknowledging and calculating NbS benefits. This requires working with colleagues from the economic field. For operation and maintenance, there is a lack of experience on NBS and capacity building on this front is much needed specially on the workable designs. Another challenge on existing urban areas includes build up areas in the wrong places which is very difficult to overcome.

Geoffrey Wilson highlighted that the largest challenge in the water sector is the availability of physical space, especially in urban areas. Traditional engineering solutions like bridges are efficient. They give specific performance at the lowest cost or smallest footprint. Even though NbS can and should be engineered, these would not be as space efficient as traditional grey infrastructures. Existing concrete

river infrastructures can be retrofitted into a beautified water course but sacrifices to features and performance would be necessary.

With regards to the economics of NBS, there are many direct benefits for flood risk management and water availability. It also provides environmental, social and economic co-benefits. There is a need to assess not only the cost and benefits of NbS but as well as the co-benefits. Hopefully, this could prove that the marginal benefits would exceed the marginal costs. Of course, there are still challenges such as limited documented guidance on how to do this and there are also questions on the transferability of co-benefits to other locations. Even the number of years for an NbS to mature should also be considered when evaluating project costs. In addition, there is still risk aversion and clients would like to see of working examples of NbS. On top of this, there is also the need for more innovative financial mechanisms for NbS.

The most challenging perhaps is creating an enabling environment for the uptake of NbS. Current public policies, regulations and even building codes supports grey infrastructure. We need policy makers and decision makers who will step up to create this enabling environment for NbS and this will take greater awareness raising, communication and knowledge building on all levels.

Tom Wilms added that social-economic benefits should also be integrated in analysis that consider the communities and their well-being. Natural capital should also be considered to ensure that environmental costs are included in cost-benefit analysis. The value of NbS also change over time and seasons which also needs to be considered. Finally, traditional solutions have more negative co-benefits over NbS which have more positive co-benefits. These dimensions would influence how we evaluate NbS projects. Bregje van Wesenbeeck highlighted that the current economic system which focus on Gross Domestic Product as a unit of performance may not be appropriate for NbS. For example, if pollution and degradation of ecosystems is considered acceptable if it leads to higher GDP or economic revenues. We are simply trapped in an economic system which is yet to consider the value of well-being for both people and nature.

***Question #3: What type(s) of information would be most valuable to you to support and/or enable NbS?***

Stefan Rau noted that access to data and information would be valuable for modelling NbS. However, data and information sometimes are considered sensitive by governments. This makes science-based modelling a challenge if one is to integrate grey and green infrastructures in projects. Information is also needed to help develop NbS business models for engaging public and private stakeholders and for encouraging investments. These data and information are needed at the early phase of the project cycle and should start at the strategy and pipeline development stages.

Geoffrey Wilson pointed out that it necessary to have dialogues with clients for understanding what their drivers are regarding NbS. Opportunities, constraints, costs, and benefits should be transparently discussed with the client to encourage buy-in. Regarding financial information, we need better understanding of concepts such as payment for environmental services and green bond markets. It is also necessary to have information on prime movements in industries and to find people and organizations who can bring about positive change in favor of NbS.

Bregje van Wesenbeeck raised the importance of communication and awareness regarding residual risks and not to set false sense of security nor expectations among people. In addition, even if there are modelling studies (such on mangroves), there is still a lack of data and information validation. Making data open and having data systems in different countries is an important first step. Tom Wilms also encouraged everyone to share their stories, communicate experiences and become an open source for NbS. We must learn from each other which will help improve how we implement NbS.

### *Closing Remarks*


Lejla Vandić, Programme Coordinator of Netherlands Enterprise Agency (RVO), provided the closing remarks by thanking the participants and expressing confidence that the webinar provided new ideas and opportunities for NbS projects with partners and clients.

It was also emphasized that raising awareness and sharing science-based knowledge will lead to higher interest on applying NbS. We all need to raise awareness about the benefits, co-benefits, and even risks to boost global demand for NbS which is important for climate resilience. Given this point, the Government of the Netherlands and its water and infrastructure sectors is moving towards establishing an international market for NbS in developing countries through collaboration and co-creation. The Government of the Netherlands is a key player and has strong commitment in promoting and implementing NbS.

The time is right to share best practices and science-based approaches by leveraging years of knowledge and experience to help make positive change. It is also hoped this engagement would evolve to an NbS community of practice with key stakeholders like ADB and Ecoshare.

# IV. APPENDIXES

## Appendix 1: Program

Day 1 NbS Lecture: 15 September 2022 (open session)
2:00 – 4:00 pm Philippines Standard Time

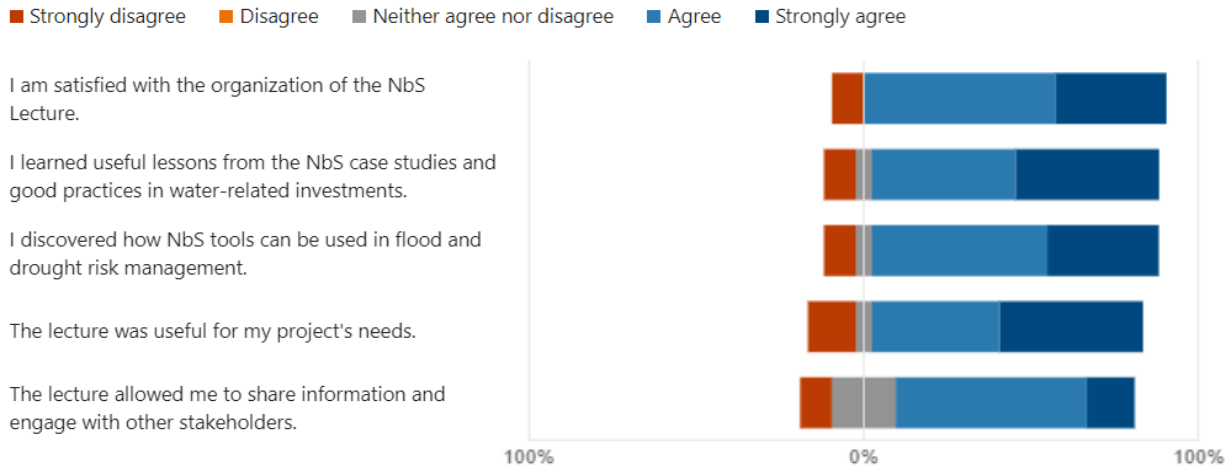
| Date & Time | Topics |
|---|---|
| 2:00–2:05 pm | **Opening Remarks**<br><br>**Qingfeng Zhang**<br>Chief of Rural Development and Food Security (Agriculture) Thematic Group and Officer-in-Charge, Environment Thematic Group, Sustainable Development and Climate Change Department (SDCC), Asian Development Bank (ADB)<br><br>**Moderator**<br><br>**Isao Endo**<br>Environment Specialist, Environment Thematic Group, SDCC, ADB |
| 2:05–3:05 pm | **Lecture on Nature-based Solutions (NbS) for Flood and Drought Risk Management**<br><br>Natural river management: A science-based landscape approach for mainstreaming NbS (with reference to Guidelines for Mainstreaming Natural River Management in Water Sector Investments - ADB)<br><br>• **Bregje van Wesenbeeck**<br>Scientific Director, Deltares<br><br>Building with nature in coasts and rivers: Promising NbS case studies (with reference to the Building with Nature – Creating, implementing, and upscaling Nature-based Solutions)<br><br>• **Tom Wilms**<br>Project Manager, Witteveen+Bos |
| 3:05–3:45 pm | **Panel Discussion**<br><br>• **Geoffrey Wilson**<br>Senior Water Resources Specialist, Water Sector Group, SDCC, ADB<br><br>• **Stefan Rau**<br>Senior Urban Development Specialist, East Asia Regional Department, ADB<br><br>**Panel Host**<br><br>**Charles Rodgers**<br>Senior Advisor (Consultant) for Climate Change Adaptation, ADB |
| 3:45–3:55 pm | **Q&A and Open Discussion** |
| 3:55–4:00 pm | **Closing Remarks**<br><br>• **Lejla Vandić**<br>Programme Coordinator, Netherlands Enterprise Agency (RVO) |

## Appendix 2: Summary of Participants' Feedback

During the Nature-based Solutions (NbS) Lecture, participants were invited to actively interact and use the chat box to offer their questions and thoughts. At the end of the session, a thorough semi-structured feedback form with nine questions was shared to get feedback on the content and overall scope of the webinar. Out of 174 participants, 21 people (12%) responded to the post-event survey. From this number, 11 were from female attendees (52.4%) and 10 responses were from male attendees (47.6%).

Figure 1 shows that most of the attendees were satisfied with the lecture because it helped them learn more about NbS. From the total number of respondents, 10% said they were dissatisfied with how the lecture was conducted. All questions related to the NbS lecture garnered positive responses. The results are summarized below.

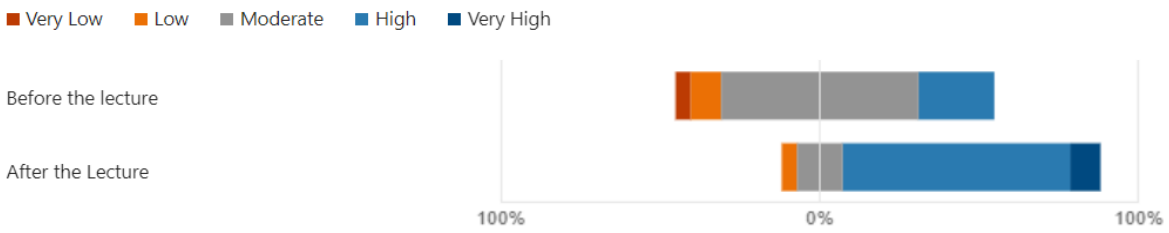
**Figure 1: Overall Evaluation**




- Most of the respondents (90%) were satisfied with how the NbS Lecture was organized. This was shown with agree and strongly agree answers while 10% were dissatisfied (disagree and strongly disagree).
- Most of the respondents (85%) learned useful information from the case studies presented and good practices in water-related investments. However, 5% were neutral and 10% indicated that they have not learned substantially.
- 85% of the participants discovered that the NbS tools can be used in flood and drought risk management, 5% were neutral, and 10% disagreed.
- 81% shared that the lecture was useful for their current project's needs, 5% were neutral, and 14% indicated that the project was not useful for their project.
- 76% of the participants declared that the lecture allowed them to share information and engage with other stakeholders, 19% were neutral, and 5% disagreed.

Respondents also rated their knowledge of the theme before and after the lecture. Almost half were not knowledgeable about the topic before the lecture and their awareness level about the topic rose to 95% after the lecture (Figure 2).

**Figure 2: Awareness Level on Nature-based Solution Pre- and Post-Lecture**




The respondents also shared positive comments about the NbS Lecture and suggested topics that can be included in future sessions. The survey results included the following statements:

- "Very useful. It was an inspiring webinar. Thanks to the Sustainable Development and Climate Change Department, ADB organizing team for organizing it."
- "It was very informative and well-organized. Managed time nicely. Well-prepared lectures and excellent presentations. My sincere gratitude for providing with this opportunity."
- "Include discussion on biosphere reserve (solution for upstream and downstream)."
- "The NbS lecture was very informative and will definitely help us for our projects. For future topics, maybe it is also good to cover the resiliency of NbS in coastal areas during typhoons and storm surges, especially since the Philippines is an archipelago and is frequently visited by typhoons."
- "Videos can be considered to show the NbS benefits and implementation as compared to the conventional one."

**Conclusion and Recommendation**

Overall, the NbS Lecture received mostly positive responses for quality and content of the webinar. There is great interest in having more time allotted for accommodating queries from participants. This showed how interested they are with the topic and how willing they are to attend similar events in the future. It also showed that the NbS Lecture was useful for the participants, and it inspired them to use NbS for their current projects.

The organization of the lecture was also applauded on how well it was conducted and how it informed the participants with the excellent presentations. Some topics were also suggested for future lectures in relation to NbS such as resiliency in coastal areas during typhoons, as well as the idea of a biosphere reserve as solutions. Video presentations were also recommended for better implementation and understanding for future lectures.

## Appendix 3: Responses to Questions from Participants

The Panel Host, Charles Rodgers, invited the resource persons to address questions from the participants. Below are the responses in brief.

**Question: With so many clear benefits of NbS, why are so many cities unwilling to commit to it?**

***S. Rau***

Previously mentioned challenges also apply to this issue of NbS uptake. Cities are looking mainly at the investment aspects and investing in grey infrastructure is still the general mindset. Mindsets in cities have to be changed. They know the numerous benefits but we also have to be champions of NbS and promote it out in the field. Caution should also be taken as there are limita to what NbS could be applied in existing urban areas. The biggest benefit is applying NbS to larger urban areas.

***G. Wilson***

NbS is difficult to implement in cities with space constraints and where the land value is high. However, there are cities that already embraced NbS, like Seoul, Republic of Korea; Hong Kong, China; and Shanghai, PRC. There are even more NbS implemented in new cities and green field cities.

**Question: How about meandering rivers…does the process of confluence of rivers consider the landscape?**

***B. van Wesenbeeck***

Many cities try to straighten river meandering. However, meanders slow down the flow of water and increases the length it travels. It increases infiltration potential of surface water to ground water.

B. van Wesenbeeck said that when you try to straighten the midsection of the river, the cities at the end will cope with more water. It is the cities that have no space to buffer the water. It is also never advisable to straighten meandering rivers.