39th IAHR WORLD CONGRESS GRANADA, SPAIN 2022 From Snow to Sea 19-24 June 2022

Proceedings of the 39th IAHR World Congress
19–24 June 2022, Granada, Spain
doi://10.3850/IAHR-39WC252171192022panel1

# HIGH LEVEL PANEL 1

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| Topic | : | From Snow to Sea — Managing enclosed seas under climate threat |
| Date/Time | : | Tuesday, 21 June 2022 / 10.00 - 11.30 h. |
| Convenor | : | Dr. Torkil Jønch Clausen<br>*Action Platform for Source to Sea Management* |
| Panelists | : | Prof. Helmut Habersack,<br>*Institute of Hydraulic Engineering and River Research, Austria,*<br>Prof. So Kazama,<br>*Hydro-Environmental System Laboratory, Tohoku University, Japan,*<br>Prof. Fernando Magdaleno Mas,<br>*Deputy Director of Terrestrial and Marine Biodiversity, Ministry for the Ecological Transition and the Demographic Challenge, MITERD, Spain*<br>Prof. Nadia Pinardi,<br>*University of Bologna, Italy, Head of the UN Oceans Science Decade program CoastPredict.*<br>Dr. Stefan Szylkarski,<br>*Executive Vice President for Water Resources, DHI, Australia* |

**Background**

As the first High-Level Panel of the 39th IAHR World Congress, this session set the stage for the overall theme "*From Snow to Sea*". After a brief general introduction to the overall subject, the Panel focused on the sub-theme "*Managing enclosed seas under climate threat*".

Our oceans are under serious threat, largely due to theeffects of land use, pollution, habitat degradation, freshwater mismanagement and climate change. Increasing competition for scarce and often polluted water threaten human livelihoods and ecosystems and biodiversity. As a result, the oceans suffer from dead zones due to oxygen depletion, plastic islands, dying corals and wetlands, and key marine species are disappearing.

Climate change intensifies the problems. Sea temperatures and sea levels are rising, extreme weather events are becoming more severe and frequent, and the vital capacity of oceans and coastal wetlands to save our planet by absorbing carbon is threatened.

The freshwater and ocean challenges are interdependent. Land-based activities affect our seas, and sea level rise, cyclones and salinity intrusion threaten coastal and riverine communities. These challenges cannot be addressed through separate actions taken by the freshwater and ocean communities. We need to bridge the current silos between them and address our challenges from a holistic system perspective – "from snow to sea"/"source to sea" – through coordinated management of land, freshwater, coasts and the ocean. The Sustainable Development Goals on water (SDG 6) and oceans (SDG 14) must be implemented hand in hand.

 

The Congress in Granada took place in the basin of one of the world's most valuable enclosed seas, the Mediterranean, and beautifully set with snowy mountains in the background. We need to accelerate source to sea action, and as a threatened enclosed sea the Mediterranean is a strong case in point.

**Purpose and scope of Panel**

The purpose of the High-level Panel was to bring senior actors from the freshwater and ocean communitiestogether to share experiences and visions for source-to-sea management, raise awareness about the issues, and discuss challenges and solutions at the local, national and international levelsin achieving coordinated implementation of SDG 6 and SDG 14.

**The discussions**

The session was opened by a brief overall stage-setting by Moderator, Dr. Torkil Jønch Clausen, Chair of the Action Platform for Source-to-Sea Management.

This was followed by a stage-setting keynote on "Source to Sea management challenges in the Mediterranean Sea" by Ms. CharafatAfailal, Former Minister in charge of Water in Morocco and Steering Committee member of the Global Water Partnership (GWP). The keynote address focused on the serious impacts in the Mediterranean due to human impacts and climate change, calling for cross-sectoral and multi-stakeholder source to sea approaches. A concrete step forward is the new "Healthy Rivers for HealthyOceans" program under the UN Ocean Science Decade, led by GWP, SIWI and UNESCO-IOC.

In their introductory interventions, the Panelists addressed various aspects of the theme:

- Prof. Helmut Habersack, Institute of Hydraulic Engineering and River Research, Austria, talked about importance of rivers and the continuity of water, sediments, nutrients or fish as well as human usages from mountains to coasts and back. The case of Danube River highlights the need of coordination between the Danube river basin committee (ICPDR) and the Black Sea Committee in order to address the issue of e.g. sediment transport and coastal erosion.
- Prof. So Kazama, Hydro-Environmental System Laboratory, Tohoku University, Japan, addressed the climate and snowmelt issue and how changes in snowmelt have on costal and marine ecosystems, highlighting the need of communication between montain and costal experts. .
- Prof. Fernando Magdaleno Mas, Deputy Director of Terrestrial and Marine Biodiversity, Ministry for the Ecological Transition and the Demographic Challenge, MITERD, Spain, focused on the land-water-biodiversity nexus and the need for coordination between stakeholdersfrom continental to transitional and coastal waters.
- Prof. Nadia Pinardi, University of Bologna, Italy, Head of the UN Oceans Science Decade program CoastPredict, provided a brief summary of her previous Plenary Keynote speech, highlighting the vision for an "integrated freshwater and ocean monitoring system" with international standards to couple SDG 6 and SDG 14.
- Dr. Stefan Szylkarski, Executive Vice President for Water Resources, DHI, Australia, discussed theGreat Barrier Reef in Australia as an open, yet enclosed system, seriously threatened by land-based activities and the need for coordinated research activities on transport pathways through river basins to the sea in order to restore the health of the barrier.

 

**Key messages to UN global Oceans and Water Conferences**
In the following Panel discussion, focus was what key message on “snow to sea” thatthe IAHR World Congress in Granada should convey to the upcoming major global events: the UN Oceans Conference in June 2022 in Lisbon, and the UN Water Conference in March 2023 in New York.Imagining a brief ‘elevator pitch’ to global decision-makers: where do we go from here, and what key actions must we take?

The following key messages emerged as outcome of the discussions:

1. Research, engineering, management and legistative activities shall operate in a coordinated way across domains in order to developoperational source to sea management approaches
2. Governance institutions responsible forregulating and managing inland water resources, coastal areasand marine environments shall develop systematic ways to share data and information
3. There is the need for an “integrated freshwater and ocean monitoring system” to support coordinated implementation of SDG6 and SDG14
4. Coastal and hydrologic research communities shall together address the need of integrated, thematically cross cutting research on pathways across river basins, from “snow to sea”, to understand and address challenges on coastal and ocean environments posed by land-based activities.

The Panelists thanked IAHR and the Spanish Organizers for the opportunity afforded by this Panel discussion and expressed hope that the key messages will be taken forward to upcoming global ocean and freshwater fora in Lisbon 2022 and New York 2023. A process will also be in place to bridge from Granada to the IAHR 2023 WWC in Vienna with the theme “Rivers – connecting mountains and coasts”

*NIBA/TJC,22nd June2022*

 

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doi://10.3850/IAHR-39WC252171192022panel2

# HIGH LEVEL PANEL 2

Topic : Water Governance

Organised by: The General Directorate for Water
*Ministry for the Ecological Transition and the Demographic Challenge. Spain*

Convenor : Manuel Menéndez Prieto
*Special Advisor in the Cabinet of the Spanish Deputy Minister of the Environment and Vice President of the Intergovernmental Hydrological Program of UNESCO (IHP).*

Date and Time: Wednesday 22 June 2022, 10:00 – 11:30 h.

Panelists : Manuel Menéndez,
*Special Advisor in the Cabinet of the Spanish Deputy Minister of the Environment and Vice President of the Intergovernmental Hydrological Program of UNESCO (IHP),*

Víctor Cifuentes,
*Head of Planning Unit in the Guadalquivir River Basin Competent Authority*

Fernando Delgado,
*Water Resources and Planning General Director in the Andalusian Regional Government*

Oriana Romano,
*Head of Unit, Water Governance and Circular Economy in the Cities, Urban Policies, and Sustainable Development Division of the OECD*

Zhongbo Yu,
*Professor in Hohai University (China) and President of the UNESCO Intergovernmental Hydrological Programme*

Rahmah Elfithri,
*Chief of Section on Capacity Development and Water Family Coordination at the UNESCO Division of Water Sciences*

Gari Villa-Landa.
*Head of International Affairs from the Spanish Association for Water Supply and Sanitation (AEAS)*

**Background**
As the second High-Level Panel of the 39th IAHR World Congress, this session stressed how a sound Governance has became a crutial component in water planning, decision making and management.

 

Climate change is exarcervating a looming water crisis and isconfronting us with challenges that require an improvement in the way in which the environmental policy is defined and implemented. Business as usual is not acceptable and new and better means are needed to improve decision making and to ensure that stakeholders and public can participate actively.

On a global scale, the need for a specific regulatory framework for water management, for strengthening institutional capacity, for greater public participation, or for developing a solid technical and scientific basis for decision-making has become evident. Ultimately, improving water governance has become imperative.

**Purpose and scope of Panel**

The main purpose of the panel was to answer the question of "How Governance can be the basis for facing water challenges?" taking into account that "best way" is a subjective issue that includes very different elements regarding social, environmental, economical, ethical and even cultural or artistic factors.

The High Level Panel contemplated different perspectives, associated with different geographical and administrative scales. Each of them linked to different needs. In fact,the improvement in governance must consider different levels of management and planning, ranging from the river basin, as the basis of natural phenomena, to national, regional, or multilateral territorial spheres, dependent on the specific socioeconomic frameworks through which the management of the river is carried out.

In consequence, the High Level Panel included participants who represent the competent authorities at a river basin district (the Guadalquivir Hydrographic Confederation), at a Region (Andalusian Autonomous Community), at national level (Moderator on behalf the Spanish Water Directorate of the Spanish Ministry for Ecological Transition and Demographic Challenge) and a multilateral institution (OECD). Additional experts on the panel highlighted the importance of having a system of water management that makes use of the best available technical and scientific knowledge (Academy and UNESCO) and described the specific needs in the urban water cycle(a representative of the Spanish Association for Water Supply and Sanitation).

**The Discussions**

The format of the High Level Panel was an introduction from the moderator and short interventions of each one of the speakers followed by a discussion with questions as:

- Which are the key principles for a sound water governance?
- What should be the role of the different actors involved in water governance: governments at different level (local, regional, national), stakeholders, science, NGOs and public?
- How we can improve the management and planning of international watersheds and aquifers?
- Wow we can stress the crucial importance of science and knowledge in the decision process?

Manuel Menéndez,_Special Advisor in the Cabinet of the Spanish Deputy Minister of the Environment and Vice President of the Intergovernmental Hydrological Program of UNESCO (IHP),made an introduction to the definition of Governance and underlined the need of considering widely the context, not only taking into account social, environmental and economic factors, but ethical and even cultural or artistic factors as well.

Víctor Cifuentes, Head of Planning Unit in the Guadalquivir River Basin Competent Authority, described the main water issues to face with. According the Spanish Water Law, River Basin

 

Districts are governed by different administrative bodies that ensure the fulfilment of the principle of water as public domain and the transparency and participatory approach to water management.

Fernando Delgado,Water Resources and Planning General Director in the Andalusian Regional Government, described the “Andalusian Pact for Water” involving all political parties, water authorities, stakeholders, academia and professional associations. The Pact proposes 10 strategic axes and 100 specific proposals in fields as Priority environmental objectives, Governance, Participation and transparency, Urban services and vital minimum, Structural deficits and sustainable demands, Mitigation and Adaptation to climate change or Cost Recovery.

Oriana Romano, Head of Unit, Water Governance and Circular Economy in the Cities, Urban Policies, and Sustainable Development Division of the OECD, stressed the essential role of a sound governance in the success of measures taken in water management. She exposed relevant examples, in different continents, of how measures can fail due to a lack of political, institutional, administrative or participatory good practices.

Zhongbo Yu, Professor in Hohai University (China) and President of the UNESCO Intergovernmental Hydrological Programme sent a video with his presentation entitled“Adressing Challenge in Water Security: Water Science, Water Education, Water Governance”. Climate change is exacervating the uneven water distribution on Earth and increasing the magnitude and intensity of floods and droughts. The Intergubernamental Hydrological Programme of UNESCO has historically addressed this issues through Science and Capacity Building.

Rahmah Elfithri, Chief of Section on Capacity Development and Water Family Coordination at the UNESCO Division of Water Sciences, described how the management of transboundary water bodies, specially aquifers, relies mainly on governance issues and how this issue is considered in the IX Phase of the Intergubernamental Hydrological Program (2022-2029).

Gari Villa-Landa. Head of International Affairs from the Spanish Association for Water Supply and Sanitation (AEAS) identified seven main challenges in the urban water cycle in Spain: Insufficient cost recovery, lack of investment, water tariffs, ageing infrastructure,Insufficient transparency, Further innovation (not just technological) and Regulatory and legislative diversity that are shared by many other countries. Measures for a sound governance include to ensure water services, Improve transparency and accountability, Improve efficiency of water services and increase the users protection.

**Key messages**

1. Sound water management cannot be achieved without robust governance that should be based on strong regulatory frameworks, improved institutional capacity, transparency and active public participation.
2. Improving governance needs a holistic approach that considers the hydrological cycle as a whole and that covers all levels of management and planning jurisdictions (river basin, international, national, regional, or multilateral territorial).
3. Governance should pave the way to facilitate the best available technical and scientific knowledge for decision making.

 

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doi://10.3850/IAHR-39WC252171192022panel3

# HIGH LEVEL PANEL 3

Topic : Artificial Intelligence

Convenors :

Dragan Savic
*Chief Executive Officer at KWR Water Research Institute, The Netherlands. Professor of Hydroinformatics, University of Exeter, UK and Distinguished Professor, National University of Malaysia.*

Vladan Babovic
*Full Professor of Department of Civil and Environmental Engineering, National University Singapore.*

Joseph Lee
*President, Macau University of Science and Technology.*

Date and Time Thursday 23 June 2022, 10:00 – 11:30 h.

Panelists :

Bojana Jankovic-Nisic
*Director of operations UK/Europe of Optimatics*

Harry Seah
*Singapore's National Water Agency*

Rebekah Eggers
*Americas Technical Leader, IBM*

Steven Brunton
*(Keynote Speaker) Professor of Mechanical Engineering, University of Washington*

**Background**

In his introduction IAHR President Joseph Lee explained the motivation for the High Level Panel (HLP) meeting. In the IAHR Strategic Plan 2020-2023, three major directions were set out for IAHR development: Eco-hydraulics and nature-based solutions, Artificial Intelligence (AI)and water, and Engagement with Africa. AI is on the national agenda of many countries. But so far AI has not really had any significant impact on the water industry and the global water challenges – such as forecast and mitigation of extreme weather events (e.g. typhoon disasters) and ecosystem services (e.g. harmful algal blooms and fisheries) impacted by climate change. Despite the rapid developments in AI in recent years, it is increasingly recognized that AI has to be explainable, and gaps exist in applying AI to transform traditional industries to create social and economic value.

**Overall Assessment**

In line with the IAHR mission to Inspire, disseminate and catalyse state of the art knowledge and thinking, and against the background of an inaugural IAHR Donald HarlemanDistinguished Lecture on AI made possible by a donation from Dr. K. K. Wong, this HLP meeting was convened to explore the latest successes, opportunities, and gaps.

 

This High-Level Panel was successful in bringing out different aspects of AI and Water: (i) what is possible with AI and recent successful real life application in water sector – ranging from the PUB example to start ups to more avantgarde applications with IBM and start-ups for water resources planning optimization (Bojana Jankovic); (ii) the importance of the human-technology partnership – including socio-economic factors - cannot be over-emphasized – e.g. co-creation, staff development, open data, public engagement and ethical issues (i.e. the importance is often substantially under-estimated, of course this is nothing new but people tend to forget); (iii) AI in water applications has many opportunities (e.g. citizen science, early warning systems) yet to be tapped; so far not disruptive enough to make a big impact; (iv) AI is interpolative in nature and is mainly a complementary tool – the limitations must be appreciated along with the power of the technology.

Overall the HLP benefits a big audience with a wide range of backgrounds (judging from the questions) – from novice and uninitiated to researchers with a little experience, to highly experienced users. It has been a noteworthy venture.

**Presentation and discussions**
In their presentations and interventions, the Panelists addressed various aspects of the theme:

**Harry Seah** - *Deputy CEO, PUB - Singapore's National Water Agency*
Heshared Singapore experience in digitization of all aspects of the water sector – from water supply, drainage, treatment, disposal and re-use. Against the background of increasing water demand, rising costs and public expectations, climate change, and land scarcity, digital transformation was essential for Singapore to keep up with the challenges. For example, Singapore's intelligent water management system uses a suite of numerical models, data analytics, machine learning to come up with alerts and trends for storm warning. The system is based on an integrated network of a large number of water flow and quality sensors.

An essential ingredient of success is to engage with staff at all levels to collaboratively to brainstorm ways to improve the system, to make life easier for the users. Harry communicates with staff in the early stages of the venture - "If you do not transform, you will be transformed!" The key is how to help your staff develop to believe in the digital transformation – which also led to better work-life balance for the professionals.

(discussion) – On the issue of open data: it is also important to manage data responsibly and communicate with the public on different types of risks – to set realistic public expectations.

**Steven Brunton** - *Professor of Mechanical Engineering, University of Washington*
Mainly cautioned against the rhetoric of AI - AI is not going to solve all our problems; it is a mainly an interpolative complementary tool that can leverage on the wealth of historical data. He believes that curating data from citizen science and AI can contribute more to disaster prevention systems (e.g. flood warning).

**Rebekah Eggers** - *Americas Technical Leader, IBM*
She shared a perspective on the trends/imperatives that are driving challenges/options to leverage technologies, including AI, in modernizing, predicting, automating and securing faster solutions. She highlighted the framework for an emerging virtual enterprise and the importance of inclusive human-technology partnerships where digitalized new ways of working result in seamless, empowered experiences for everyone involved.

According to her, AI can play an important part in science, technology and innovation. And Sustainability.

 

AI has played a great role in automation of complex work flows; main thing is to integrate AI into what we do every day. AI can help to reduce carbon. Shesees huge opportunities in AI.
An inclusive human-technology partnership is essential for success in AI applications; – e.g. ethical AI is rising concern. AI is contextual and related to culture.

**Bojana Jankovic** - *Nisic - Director of operations UK/Europe of Optimatics*
She envisages a new era for capital improvement planning in the water sector under VUCA (Volatility – Uncertainty – Complexity – Ambiguity) conditions, or in other words how to improve decision-making for "wicked" water problems. As a potential way of dealing with such problems, she introduced "Optimizer", a multi-objective evaluation and optimisation platform that has its origins in Artificial Intelligence and evolutionary algorithms. Ways of dealing with VUCA and water problems using Optimizer were demonstrated through a number of case studies.

**Dragan Savic** - *KWR Watercycle Research Institute, Netherlands*
He indicated how global water security, which is a multi-dimensional and enduring human goal, can benefit from Artificial Intelligence and data analytics methods. He reminded the audience how digital technologies are transforming our society, e.g., banking, entertainment, tourism, etc., but also how the Gartner "hype cycle" for AI is also relevant to the water sector. He concluded that digitalisation technologies and hydroinformatics solutions are largely available and the water sector is already benefiting from hydroinformatics advancements, but special attention should be paid to culture change and the human component of the digital transformation

**Vladan Babovic** - *National University Singapore*
Vladan emphasized on painted a futuristic picture where AI is seamlessly fused with all kinds of data from sensor networks, radars, and crowd sourcing to help with smart water management.

With phenomenal advances made in fields machine learning, big data and cloud computing over the last decade and more to come in areas such as internet-of-things, we are at the precipice of a big change in applied hydro-science and engineering.

Improving water resources management requires improved computational tools for forecasting floods, planning response and design of infrastructure. In particular the computational tools for flood management are designed around (i) data components for rainfall, stream water levels and discharges, topography, land-use and hydraulic structures and (ii) two-dimensional dynamic flood simulators. As significant uncertainties do exist in rainfall and topographic data at high resolutions, multiple sources of data, traditional and opportunistic, for rainfall and flood incidence, and topography and land-use can be used to improve reliability of the flood simulation model. Next generation of advanced, so-called sub-grid flood simulator provides a trade-off between accuracy and speed. An integrated multi-source data, AI and simulation model workflow enables rapid setup of base flooding models anywhere in the world where data and simulation results feedback to each other improving quality of both. A conceptual framework for smart water management was outlined, the framework that provides a basis for continuous improvement and blending of data and simulation models using AI, thus enabling continuous updates on the knowledge about the system.

 

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# HIGH LEVEL PANEL 4

Topic : Nature-based Solutions and Ecohydraulics

Title : Upscaling the Implementing Nature Based Solutions for Climate Change Adaptation – Perspectives from Government and Science

Convenors : Ellis Penning
*Expert on Nature-based Solutions and Aquatic Ecology, Deltares.*

Jochen Hack
*Chair for Digital Environmental Planning, Leibniz University Hannover – Institute of Environmental Planning.*

Date and Time Friday 24 June 2022, 10:00 – 11:30 h.

Panelists :

Mr. Malik Fida A. Khan
*Executive Director of the Center for Environmental and Geographic Information Services (CEGIS) and member of the National River Conservation Commission (NRCC) in Bangladesh*

Dr. Eva Hernández Herrero
*Leader of the Living European Rivers Initiative at WWF Spain*

Prof. Hyoseop Woo
*Past Director of Korean Institute of Civil Engineering and Building Technology (KICT) and Professor at Sejong University, South Korea*

Dr. Marjolein van Wijngaarden
*Director Strategy - Boskalis NL and Chair of the Advisory Board Ecoshape*

Dr. Eileen Burke
*World Bank's Global Lead for Water Resource Management*

**Background**

Climate change affects communities around the globe and often through water related challenges such as increased flood and drought risks. The related impact on drinking water availability and food production, risk of waterborne diseases, and damage to properties and coastal zones are high and increasing. At the same time, we see an increased call for Nature-based Solutions (NbS) to help solve these challenges. Many demonstration projects have been implemented but upscaling remains difficult. Yet, there is a clear notice, also resulting from the recent COP26, that we need to speed up this implementation. Science can play an important role in providing knowledge to upscale the implementation of NbS, such as results from eco-hydraulic research and innovative monitoring of natural dynamics in water systems.

 

**Purpose and scope of Panel**
The purpose of the High-level Panel was to bring high level actors from governments, NGOs, industry, science, and finance together to share experiences and visions for upscaling the implementation of NbS and discuss their role and contribution in this process.

During this High Level Panel, the following questions were discussed:

- 'What is needed for upscaling NbSimplementation?'
- 'What is the role of governments, financial institutions, science, NGOs, and the public sector in facilitating the uptake of NbS?'
- 'How does the local context affect the easiness of upscaling implementation?'
- 'What can we learn from successful cases?'
- 'How can the IAHR-community contribute to upscalingefforts?'

**The discussions**
The session was opened by a brief overall stage-setting by Moderator, Dr. Ellis Penning, Chair of the IAHR working group on Nature-based Solutions, explaining the increasing call for Nature-based Solutions worldwide. Despite many pilots and examples, mainstreaming and upscaling the implementation of NbS remains challenging.

This was followed by a series of short pitches of the panel members, in which they addressed their role in NbS implementation and presented inspiring examples of their favourite Nature-based Solutions.

Mr. Malik Fida A. Khan,Executive Director of the Center for Environmental and Geographic Information Services (CEGIS)andmember of the National River Conservation Commission (NRCC)in Bangladesh,explained the wide variety of NbS already being implemented within Bangladesh and how these benefit the local communities, ranging from floating agriculture to tidal river management and coastal protection by mangrove forests.

Dr. Eva Hernández Herrero,Leaderof the Living European Rivers Initiative at WWF Spain explained the importance of stakeholder involvement in the successful implementation of NbS and the role NGOs play in bringing additional arguments for natural river management to the table.

Prof. Hyoseop Woo, Past Director of Korean Institute of Civil Engineering and Building Technology (KICT)and Professor at Sejong University, South Korea, addressed the importance of reviving ancient management practices as these often have a Nature-based character underlying them. For instance, the role of floodplain forests to protect adjacent lands from riverine flooding is a common traditional practice in South Korea. A second example was the daylighting of an urban stream in Seoul, whichprovides many benefits to the local residents ranging from flood risk and heat island reduction tobeautification and appreciation of the general area.

Dr. Marjolein van Wijngaarden, Director Strategy - Boskalis NL andChair of the Advisory Board Ecoshape,expressed the importance of cooperation with industry to effective realization of implementation. In this, the industry can play a pivotal role in upscaling by making projects at scale possible. The joint collaboration efforts were undertaken in the Dutch Ecoshape consortium, which brought industry, research institutes, and consultants together to develop relevant knowledge through pilots resulting in iconicNbS projects such as the Sand Engine in the Netherlands. These pilots have helped to increase the general acceptance of NbS as a more standard approach in the Netherlands.

 

Dr. Eileen Burke,World Bank's Global Lead for Water Resource Management, explained the twofold role of the World Bank in the implementation of NbS, one for providing relevant practical guidance and one for being the primary lender and funder in many large scale projects where NbS may be part of the overall strategy towards water management challenges. Especially for water retention measures, there is a clear need to better use natural water retention measures to provide the much needed storage capacity.

After these pitches, there was a round of interaction with the audience through the use of menti.com, moderated by Dr. Jochen Hack,Member of the Leadership Team of the IAHR working group on Nature-based Solutions, to gain insight into the view of the audience on NbS. Many people (n=140) knew of NbS in their country and common words related to NbS included resilience, adaptation, biodiversity, vegetation, sustainability and restoration (Fig. 1)

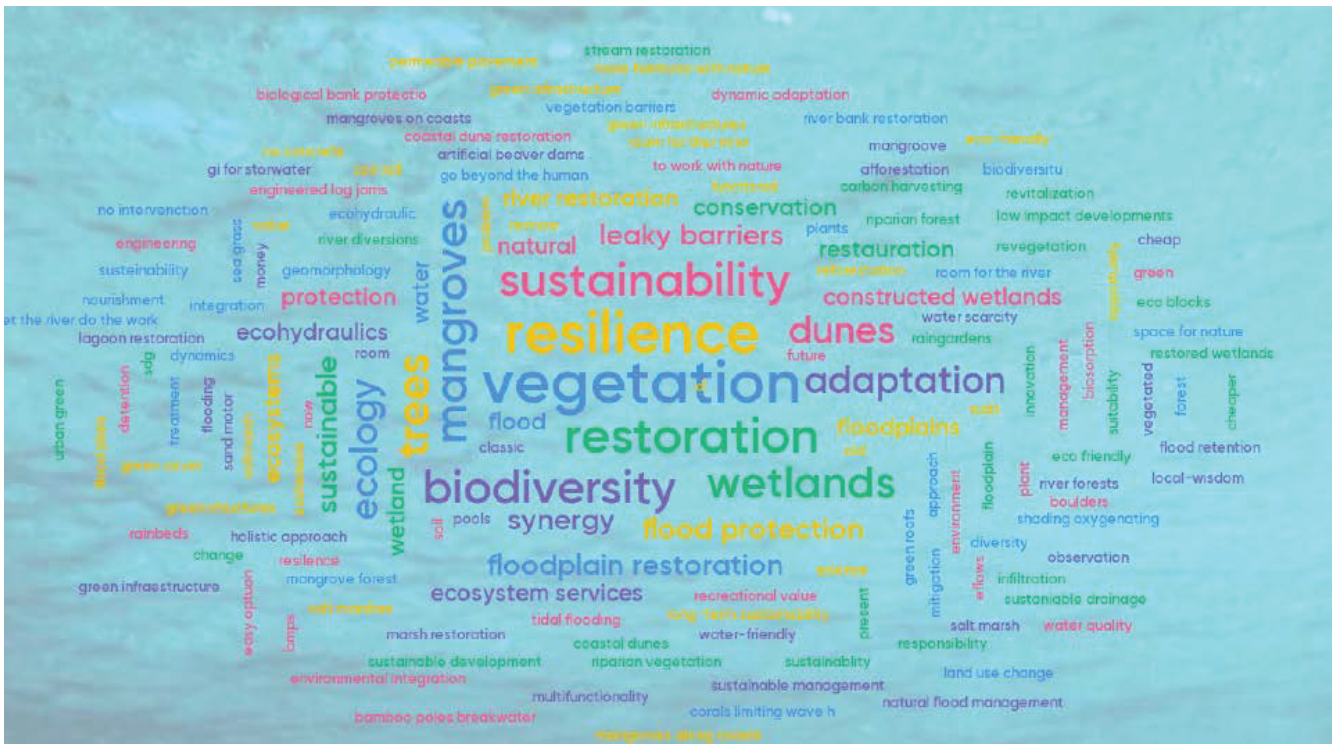


Figure 1. Wordlerelated to the words associated with Nature-based Solutions by the audience (n=140)

Four statements to which the audience responded were discussed with the panel members (Fig.2).The audience indicated the clear need for better documentation of successful examples to help implementation of NbS. The panel responded that there are many sources of information, but these may not be known to the wider community. The working group on NbS will provide an overview of these sources on the IAHRworking group sub-website. This also related to the acknowledgment of the audience that engineers still are looking for more knowledge to help implementation of NbS. There was a general perception that involving stakeholders is time-consuming. The panel indicated that the involvement of stakeholders is crucial forthe successful implementation of NbS. Specialized NGOs and consultants can help in this process. The role of science to further system understanding was generally acknowledged.

 

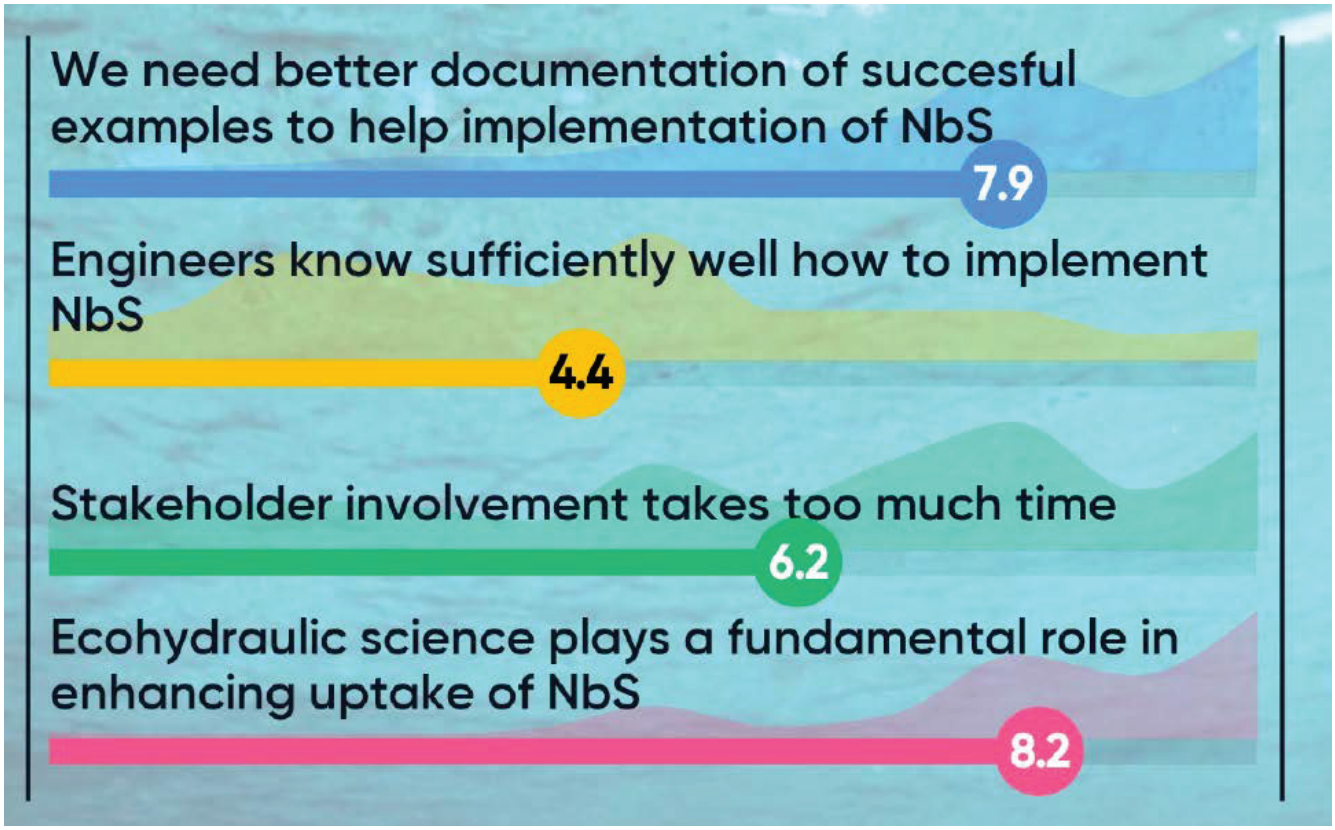


Figure 2. 4 statements related to challenges to implement NbS on a wider scale

**Key messages to the IAHR community**

The following key messages emerged as an outcome of the discussions:

1. Different actors such as science, industry, NGOs, governments, and financial institutes all have a role to play in the successful impelmentation of NbS
2. Also, the panelpointed to the role that each individual one of us has a role to play in the implementation of NbS by addressing the question if a Nature-based alternative solution can be placed next to a more traditional one for a given challenge.
3. Good system understanding lies at the heart of the implementation of solutions, both from the bio-physical aspects and the socio-economic and governance aspects.

The Panelists thanked IAHR and the Spanish Organizers for the opportunity providedby this Panel discussion and expressed hope that the community of people working on NbS at IAHR will be growing in the near future and become a platform to share knowledge and information as broadly as possible.New initiatives towards the IAHR 2023 WC in Vienna with the theme “Rivers – connecting mountains and coasts” will be further explored.

 