SIWI WORLD WATER WEEK

Seminar: Sustainable infrastructure for inclusive green growth

ABSTRACT VOLUME

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Seminar: Sustainable infrastructure for inclusive green growth

Contents

Building inclusive basin resilience: Adopting a 'livelihoods project portfolio' approach

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Keywords
resilience, livelihoods, infrastructure, transboundary river basin, southern Africa

Highlights
Adopting a 'livelihoods project portfolio' approach to tackling poverty, inclusion and resilience in a river basin is a means of leveraging climate finance and enabling broader, cross-sectoral (hard and green) infrastructure development and inclusive growth.

Introduction and objectives
Transboundary river basins in southern Africa face a range of social, environmental, climatic and political challenges, all of which impact on the resilience of its people, ecosystems and economy. To this end, extensive engagement with river basin organisations, government entities and financiers has indicated a consistent and clear demand for support regarding the development of 'inclusive water infrastructure' - that is, climate resilient livelihoods projects that directly address the challenges faced by vulnerable populations within a basin. However, when viewed in isolation, these relatively small-scale interventions are not bankable/attractive investments, and developing and financing them has therefore proved very difficult.

Methodology approach
Individual livelihoods projects are often not viable because they are unable to leverage the linkages between infrastructure (hard and green), ecosystems, water-food-energy nexus value chain opportunities, and other cumulative impacts of infrastructure provision. However, using vulnerability criteria as a means of identifying and developing suites of small-scale projects not only tackles issues of poverty, inclusion and resilience in a river basin, but importantly, acts as an enabler for broader nexus infrastructure development. It results in a bankable portfolio of livelihoods projects that fit within a vulnerability and resilience framework, with increased impact through economies of scale and cross-sectoral reach.

Analysis and results
Using a scientifically robust, stakeholder-validated approach to identify vulnerable areas within a basin informs the conceptualisation/design of livelihoods projects that respond to specific challenges. This approach also provides a consistent basis upon which to justify climate funding applications for suites of these projects (that consider both human development needs and the value of the natural ecosystem).

To this end, the UKAID-funded Climate Resilient Infrastructure Development Facility is piloting a water-poverty-vulnerability mapping process in the Cubango-Okavango river basin. The basin has limited water storage, and analysis by the World Bank suggests that this situation is not sustainable as increasing population pressure leads to growing rates of land degradation - ultimately threatening the basin's internationally important biodiversity status. Research also concludes that the people of the basin are poorer, less healthy and have less education as compared to other groups in their respective countries. To address these social justice issues and drive pro-poor growth, climate resilient water infrastructure will play a key role. This study therefore arose off the back of the Multi-Sector Investment Opportunity Analysis project, with the

Permanent Okavango River Basin Water Commission (OKACOM) articulating a need to pilot, mobilise finance for, and scale-up programmes of water infrastructure projects.

Conclusions and recommendation

This approach has been endorsed by several river basin organisations in southern Africa because it has been such a challenge identifying and mobilising funds for small-scale projects. As such, efforts are underway to ultimately expand and apply the approach to the Limpopo and Zambezi basins.

While the methodology remains consistent, its application must be tailored to: i) address specific basin challenges (which largely depend on the natural resource endowments and comparative advantages of the river basin's member states); and ii) make use of previous studies and available vulnerability, poverty and climate change data per basin/member state.

Can Africa take the lead on sustainable infrastructure?

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Keywords
infrastructure, sustainable, water, sanitation, Africa

Highlights
Explores present efforts on the use and incorporation of green infrastructure across Africa;
Considers the role of MDB's in promoting the development and use of an appropriate mixture of green and grey infrastructure as 'sustainable infrastructure';
Outlines a framework to help integrate the approach of sustainable infrastructure into decision-making processes.

Introduction and objectives
Water resources across Africa face multiple risks, including impacts from climate change, increased urbanization, and population growth amongst many others. The promise of sustainable infrastructure as a means of addressing water resource challenges, and SDG6 including Targets 6.1, 6.2, and 6.6, is yet to be fully explored. The objective of the study is to identify African examples of sustainable infrastructure, where a mix of grey/green is utilized, or green infrastructure in action. These are used to develop a framework that can help to ensure that key opportunities for sustainable infrastructural approaches are adequately considered.

Methodology approach
The study seeks to answer two main questions using a mixture of desk research and subsequent analysis/evaluation of case study examples:
1) To what extent can green infrastructure be found in Africa as part of Sustainable Infrastructure, and is this a core or supplementary activity? 'Core' refers to using an appropriate mix of green/grey infrastructure explicitly designed to operate in tandem;
2) Are there enough examples of using Sustainable Infrastructure in African contexts, as a combination of grey/green to develop a framework that will enable natural infrastructure to be potentially seen a key asset/opportunity for the water resources sector.

Analysis and results
The study reveals a limited number of examples from Africa, such as built wetlands as part of wastewater networks, however they are not widespread. The capacity and desirability of using green infrastructure has been constrained by different factors, including enabling environments, access to resources, and general acceptance of green infrastructure as a tool. As a major provider of financial resources, this study is timely to explore the role that green infrastructure plays within the AfDB portfolio and therefore could contribute to Sustainable Infrastructure. Overall the review finds that the use of green infrastructure is not regularly promoted or understood, and when it is, then often it is seen as a complementary activity as opposed to being regarded as a core component. Despite this finding, a number of lessons emerge that are critical to understanding how much of a role sustainable infrastructure can play within the AfDB's future activities, and whether sustainable infrastructure smoothly fits the African context. These are included in the development of a framework to aid understanding amongst policy makers.

Conclusions and recommendation

There is potential for incorporating complementary grey and green infrastructure as sustainable infrastructure across Africa, especially as a tool that can achieve different targets under SDG6 and address the Energy-Food-Water Nexus challenge. However, at first glance, the conditions and enabling environment for applying this appear to be more limited than in other global locations. The study reveals a number of factors that are important for successfully developing sustainable infrastructure - including clear connections between water source and beneficiaries, the presence of active leadership, etc., which should enable more extensive use in the future and take the lead.

Controlling water disasters and building resilience through innovative underground storage

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Keywords
Floods, droughts, groundwater depletion, managed aquifer recharge, Ganges Basin

Highlights

- A new solution has been developed that converts water-related disasters into rural livelihood opportunities that enhances community resilience
- The solution synergizes natural infrastructure (aquifers) with built infrastructure (ponds and canals)
- Piloting has been successful and influenced policy in India with plans for next-level scaling-up

Introduction and objectives

Pragmatic yet effective approaches for controlling the impacts of floods and droughts are greatly needed in many developing countries. Our solution serves to overcome the spatio-temporal mismatch between surface and groundwater supply and demand within river basins through targeted recharge of excess wet-season flows into depleted aquifers. Its application at the river basin scale reduces local/downstream flooding and drought risks by boosting groundwater reserves. This presentation gives an overview of the solution, known as ‘Underground Taming of Floods for Irrigation’ (UTFI), and details the outcomes from its implementation and wider implications for inclusive and sustainable development in the Ganges Basin.

Methodology approach

A mix of research, practical implementation and stakeholder engagement is applied. The evidence-base for UTFI is created through interconnected activities that include site suitability assessments, pilot testing and demonstration, hydro-economic modelling, institutions and policy analysis, community mobilization and capacity building. Thoughtful planning and staging combined with a multi-disciplinary approach serve to ensure that key risks are identified and addressed for smooth transitioning from piloting through to scaling up. Translation of research data to communication tools and other forms of guidance are the basis for engaging with a range of stakeholders, including prospective proponents of UTFI.

Analysis and results

Regional assessments reveal much of the Gangetic Plains is potentially well-suited to UTFI implementation. A pilot trial site was established at the village scale in western Uttar Pradesh in India following a comprehensive site selection process. Three years of testing involving the recharging monsoonal flows diverted from an adjacent irrigation canal via a retrofitted village pond demonstrates that significant quantities of water can be stored underground each year without unduly compromising groundwater quality. Social acceptance of the trial has been encouraging and local governance arrangements are being strengthened.

Integrated hydrologic modelling suggests scaling UTFI across the Ramganga basin would generate significant social and economic benefits by reducing floods, restoring groundwater levels and baseflows, and boosting agricultural production. Scaling-up would also be economically attractive.

Site visits and Open Days organized for government officials, local community and media have helped to better communicate how UTFI functions and its potential applications. This has resulted in strong support from local decision makers. Annual maintenance of the trial site has been integrated with a national flagship program on rural employment and involves strong community participation. UTFI has been formally recognized by the Government of India and included in district irrigation plans that enable next-level scaling-up.

Conclusions and recommendation

Knowledge on the performance, scope and modalities of UTFI has advanced and is continuing to grow. Some inclusion into government policy has emerged within a relatively short space of time. These successes support the view that policy makers and investors across the Ganges can consider UTFI when making investment decisions that relate to the SDGs, water-related disasters, climate change adaptation, watershed management and rural livelihood development. Although current work is firmly grounded in South Asia, the concept emerged in Thailand and there are clear opportunities to apply UTFI to other regions.

Developing a robust water strategy for Monterrey, Mexico

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Keywords
Long-term water planning; complex planning contexts; deep uncertainty; developing countries

Highlights
1. We use advanced computational tools and participatory planning to develop a robust adaptive water master plan for Monterrey, Mexico
2. The resulting master plan considers infrastructure and policy diversification for coping with climate, economic and technological uncertainties

Introduction and objectives
The City of Monterrey in Nuevo Leon is rapidly increasing its demand for potable water due to its growing industrial activity and population. It is widely believed that the expansion of the city´s water infrastructure is a key measure needed to support future water demand. However, environmental concerns of different projects and more importantly climate change and water demand uncertainty have increased the complexity of this decision.
This study describes the results of applying the Robust Decision Making method for developing a water master plan for Monterrey which adapts to unfolding climate and demand conditions.

Methodology approach
This research describes an integrated computational framework that was developed for supporting the State of Nuevo Leon's water infrastructure decisions. This framework uses three different computational models: a water demand Monte-Carlo simulator, a water supply hydrological model and a dynamic optimization model. This framework is used in a computational experiment that uses a large ensemble of future scenarios exploring a vast space of water demand, water supply scenarios and policies. The resulting database is then analysed using machine learning algorithms to identify the factors that increase or reduce the vulnerability of different policy portfolios.

Analysis and results
Our results show future water demand in the city can be met progressively through a combination of different projects (e.g. efficiency, surface, groundwater and desalination) and policies (i.e. water tariffs). In the short term, small-to-medium scale grey infrastructure that take advantage of different water sources can be used to meet future demand in the face of climate and technological uncertainty. In the medium term, the combination of water efficiency and medium size grey infrastructure projects can help the city meet future demand and save close to 1 billion dollars in infrastructure investments.

Conclusions and recommendation

Our analysis shows that the status quo water plan was highly vulnerable to negative precipitation changes that are well within the span of past experience for the city. While the predominant view before this study was financing a single big alternative, our results showed that this was also a fragile plan since it is critical to diversity risk among the different project options, thus instead of following the traditional planning approach of incremental huge investment, the City of Monterrey should consider developing a diversified and adaptive master plan of project investments.

Disseminating nature based solutions: Gains, evidence of impacts and others

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Keywords
Nature Based Solutions, evidence-based, enabling environment, case-studies, WWDR

Highlights

- An overview of Nature Based Solution (NBS) case-studies from over the globe which give evidence of the impacts the solutions had.
- Explanations on why a NBS was chosen over grey-solution possibilities.
- Lessons learned of NBS that have been put into practice on the inclusion of governance during the implementation.

Introduction and objectives

The World Water Development Report (WWDR) of 2018 will focus on nature based approaches that are articulated as 'solutions' to flag their current, and potential, contribution to solving or overcoming the major contemporary water management problems or challenges. The report highlights the need for evidence of impacts and inclusion of governance of these Nature Base Solution (NBS). This research aims to strengthen the WWDR2018 by collecting NBS from over the globe that are able to show the theory of the report in practice, and by extracting from each study the gains, evidence of impacts and the enabling environment of NBS.

Methodology approach

Guiding principles for nature based solutions as an alternative to or complementary to conventional engineering measures have been developed in the past year (Implementing nature-based flood protection I Principles and implementation guidance. Deltares, GFDRR, the World Bank, Ecoshape and UNDP). The case-study collection will also reflect on the guiding principles and whether the demonstrated cases indeed conformed themselves to these principles.

Analysis and results

The case studies will collectively highlight:

1. what the NBS is and for which problem it has been designed;
2. why the case study is a NBS and why it was chosen above a so-called grey solution;
3. what the hydrological and socio-economic evidence is to demonstrate that the solution was successful; and
4. how it came to be a sustainable solution for the system as a whole and how were policy, governance, financers and other stakeholders involved to enable the implementation of the NBS into this same system.

Conclusions and recommendation

The case-study collection is available on www.naturebasedsolutions4water.com, enabling any user of the WWDR2018 to extract relevant case-studies and the lessons learned to use in governance, education and practice.

Enabling collaborative investment in sustainable infrastructure to restore catchment resilience

Presenting Author: Prof. Stuart Bunn, Water Future, Australian River Institute, Griffith University, Sustainable Water Future Programme, Australia

Co-Authors:

Keywords

Ecosystems, Water Quality, Modelling, Agriculture

Highlights

- This project seeks to improve catchment resilience to extreme weather events through improved planning and implementation of green infrastructure in the landscape.
- The aim is to develop spatial planning and visualization tools that can be used to guide on-ground investment to reduce sediment and nutrient loss, and minimize flood risk.

Introduction and objectives

Many catchments in eastern Australia are in poor and declining condition. During intense rainfall events, streams and rivers break their banks causing extensive damage to homes and infrastructure and shifting millions of tonnes of high quality top soil from agricultural areas. Eroded sediment is transported downstream impacting on water treatment plants, decreasing water storage capacity before settling in shipping channels and smothering marine habitats. In our changing climate, this is likely to happen more frequently than before, and there is growing recognition of the need for large-scale and targeted investment in catchment remediation projects as a cost effective long term management approach.

Methodology approach

A spatial planning tool has been developed to explore options for on-ground investment to reduce sediment and nutrient loss, and maximise biodiversity outcomes. An innovative digital interface will enable realistic visual representations to facilitate discussion with investors and the local community. We will use the tools to run scenarios and explore trade-offs and synergies – noting there are multiple and sometimes competing objectives. For each scenario, we will also explore implications in terms of additional public and private benefits (e.g. minimize flood risk). This deliberative process can facilitate broad stakeholder engagement to identify what actions to take and where best to take them, and result in multiple benefits to the community, the economy and the environment.

Analysis and results

As in many parts of Australia, more than half of the channel length of streams in south east Queensland is in poor condition. Clearing of vegetation, modifications to stream channels, frequent burning and overgrazing in headwater catchments has led to a flashier response to rain events, with more water concentrated in the channel network, and increased stream power. To compound this problem, stream banks and gullies have become more vulnerable to erosion – the source of much of the sediment and nutrients that end up in our reservoirs, drinking water treatment plants, ports and coastal waterways. This not only continues to drive up the costs of water management and infrastructure maintenance (e.g. bridges, harbour dredging) but also poses a major threat to coastal ecosystems. We understand the cause of the problem, what actions are effective, and where they will have the greatest benefit.

Downstream beneficiaries are becoming interested in investing in upstream works to tackle the problems at source but on-ground investment to date has been small-scale and often not targeted to maximize outcomes for the least cost. Investors (and environmental regulators) must have confidence that targeted interventions will deliver benefits that not only justify the expenditure but are also socially acceptable and low risk.

Conclusions and recommendation

The challenge is to move beyond the current incremental approach and there is growing acceptance that we need a coordinated, catchment-scale planning approach to optimize investment for multiple benefits. There are also significant institutional barriers to overcome to facilitate implementation at scale. An evidence-based, spatial investment tool can support deliberative engagement and negotiation between the community, government agencies and investors. We believe that building stakeholder confidence through this process is key to mobilizing investment and to overcome remaining institutional barriers to address this problem at the scale required.

Groundwater-based natural infrastructure: An overview and outlook

Presenting Author: Ms. Karen Villholth, International Water Management Institute, South Africa
Co-Authors:

Keywords
Groundwater-based natural infrastructure, managed aquifer recharge, ecosystem services, integrated water management

Highlights

- Groundwater plays as critical role in sustaining ecosystem services (ESSs), while also itself dependent on ESSs
- Groundwater-based natural infrastructure is an evolving field that offers solutions for enhanced water security and resilience
- The GRIPP network brings partners together to co-develop and outscale solutions

Introduction and objectives

While groundwater supports and underpins many ecosystems and their services, and also itself depends on certain services for its proper and sustainable function, only recently has the term groundwater-based natural infrastructure (GBNI) been coined – in order to emphasize a sweep of solutions that hinges on groundwater and subsurface services and, by manipulating flows, storages and certain biophysical properties, intends to increase water security and resilience through planned and integrated approaches. The presentation gives an introduction and overview to GBNI, various approaches and how these have been applied around the world, the successes, trade-offs and ways forward.

Methodology approach

Through literature and interaction with key players in the field of recognized technologies such as managed aquifer (or artificial) recharge, integrated land management, river bank filtration, and other solutions that hinges on groundwater, a new term groundwater-based natural infrastructure (GBNI) is introduced. It encompasses a multitude of technologies, with various degrees of grey and green infrastructure that uses groundwater or the subsurface to increase water security and resilience. The spectrum from simple and small-scale solutions focusing on enhancing water storage to hi-tech solutions, which also optimises water quality is presented. Critical issues related to socio-economics, governance and institutions are examined.

Analysis and results

The overview highlights that GBNI solutions require integrated and multi-disciplinary knowledge of the bio-physical as well as socio-economic and institutional context in order to realize the potential benefits of water security and resilience without compromising ecosystem sustainability. Long timeframes of groundwater response to nature-based infrastructure interventions and the non-visibility of groundwater provide both the challenge as well as the positive prospects of GBNI. When manipulating recharge and flow pathways of water through the water cycle, as a critical aspect of GBNI, the tradeoffs and short- and long-term impacts need to be understood. Some of the positive benefits involve reliable water supply, enhanced performance of groundwater-dependent ecosystems, less evapotranspiration from water storage, possible water quality enhancement, as well as reduced flood and drought risk. Equitability in benefit accrual and financing are aspects requiring further attention, especially in developing countries. GRIPP (Groundwater Solutions

Initiative for Policy and Practice) is a global initiative of 30 international partners with a mix of groundwater expertise coming together to highlight the role of groundwater in the 2030 Agenda for Sustainable Development and to co-develop integrated and sustainable solutions that rely on or impact groundwater. GRIPP and collaborating partners are actively pursuing the opportunities that GBNI provide.

Conclusions and recommendation

Knowledge of the scope, options and tradeoffs of GBNI, from a technical and socio-economic perspective, is increasing, but they need further attention in policy development and investment planning when it comes to increasing water security and resilience. Technologies need to be made more widely accessible and tested under various contexts, and impacts for further outscaling better understood. This is critical as groundwater is increasingly relied on for water supply, industry and irrigation. So, assuring these groundwater-based services, while not undermining the groundwater resource, but in fact purposefully enhancing its services and sustainability though well-planned and integrated GBNI approaches is key.

How to assess hydrological performance in water sensitive infill development

Presenting Author: Mr. Xuli Meng, International Water Centre, University of Queensland, Australia

Co-Authors: Prof. Steven Kenway, University of Queensland, Australia
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Keywords

Water metabolism, Hydrological analysis, Open space ratio, Green fence, Water sensitive urban design (WSUD), Integrated Water Management (IWM)

Highlights

This study evaluated how direct urban flows impacted the urban water metabolism indicators of a case study in Brisbane. The novel contributions in this project are to develop the WSUD applications to improve hydrological performance and monitor performance through water metabolism evaluation framework.

Introduction and objectives

This report is searching for better option to mitigate high volumes of stormwater runoff, spatial variation, and decreasing liveability in Norman Creek catchment, Brisbane.

1. To model water performance (water mass balance) in research area with different scenarios;
2. To assess the hydrological performance in new WSUD options and analyse how they mitigate water-related issues with Integrated Water Management (IWM) perspective;
3. To generate some recommendations for the future research and development in the study site.

Methodology approach

This study aimed to assess WSUD options for infill development in the Norman Creek catchment through UMEF4Water.

Generally, there are six stages in the UMEF4Water for infill development, developed by Renouf, et al. (2016), based on the original concept from Kenway, et al. (2011), involving:

1. Defining the system boundary.
2. Determining key water-related issues.
3. Collecting land use data through using spatial analysis tools.
4. Defining water sensitive infill development scenarios.
5. Generating a water mass balance.
6. Assessing water metabolic performance through indicators.

Analysis and results

The linear park from option 8 with maximised implementation has the best perviousness performance, with nearly 6% improvement and those in the other 7 WSUD options improvement less than 3%. Noticeably, option 1 rainwater reuse and option 2 greywater recycling will only effect on a couple of factors in the table without changing imperviousness, runoff (Rs), evapotranspiration (ET) and groundwater infiltration (GI) at all.

Moreover, the linear park also has the best hydrological performances on Rs, ET and GI. The estimated figures indicate that compared to base case Business-As-Usual BAU in 2031, stormwater runoff will be as low as 22.3 GL/yr, which is a decrease of over 6%. For evapotranspiration and groundwater infiltration, they will increase 1.3 GL/yr (14%) and 0.2 GL/yr (17%) respectively relative to 2031 BAU.

Additionally, all 8 WSUD options are simulated and assessed by one indicator, total stream discharge (Table 5) for hydrological performance analysis. It can be clearly seen that all options will influence streams involving both 'natural' flows and 'anthropogenic' flows, but only option 2 greywater recycling (maximised implementation) and option 8 linear park (maximised implementation) will reduce streams outflow over 5%.

Conclusions and recommendation

This report demonstrates how a 'water metabolism' perspective can be used to generate water efficiency and performance indicators to assist water resource management in the study area due to high demand for water sensitive infill development. In addition, this perspective is considering both 'anthropogenic' and 'natural' water cycles and the interactions between them within the whole catchment.

Three recommendations are:

1. To add more detailed data in the in-depth evaluation system;
2. To develop the integrated corridor strategy to influence the stormwater runoff and overland flow flooding; and
3. To develop more appropriate indicators from an UMEF4Water perspective.

Implementing a social-ecological landscape approach for wetland management

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Keywords
Wetlands, Landscape approaches, Ecosystem services, Socio-ecological systems

Highlights

Outlines the need for a more integrated socio-ecological landscape approach to wetland management in order to balance ecosystem services with livelihood needs and maintain natural infrastructure;
Discusses field experiences of implementing a 'functional landscape approach' within several diverse wetland-using communities;
Identifies areas of good practice in working with local communities

Introduction and objectives

There is growing recognition that the complex challenge of maintaining water ecosystems with human development needs does not lend itself to narrow disciplinary-based management solutions, and in recent years attention has turned to how integrated landscape approaches can potentially offer an alternative and more sustainable way forward. In this seminar we draw attention to the important contribution of wetlands to human development in sub-Saharan Africa, and how these complex socio-ecological systems arguably require the adoption of a landscape management approach if their environment and socio-economic benefits are to be sustained.

Methodology approach

Our research over 20 years on sustainable wetland management in sub-Saharan Africa has driven the development of a 'Functional Landscape Approach' (FLA), which focuses on analysing and supporting the socio-ecological functional linkages between wetlands and catchments, and identifying specific interventions (e.g. soil conservation, afforestation, buffer zones) that improve the sustainability of landuse and water supply as well as developing resilience to change. Critically, this process places local users at the forefront of adaptive co-management following an initial intervention, and in this seminar we report on action research-led field experiences of implementing the FLA with a range of local communities.

Analysis and results

An overarching theme emerging from this work has been the importance of recognising the socio-ecological uniqueness of wetland-catchment setting; farmer-led participatory research was successful in identifying what was important to each individual FLA community in terms of access to livelihood assets, local institutional dynamics, ecosystem services and the environmental characteristics of the wetland-catchment system itself. This was critical because it recognised that many local users already possess detailed knowledge and experience of landscape linkages, but also because it informed their selection of specific FLA management interventions. While the success of these management interventions has been difficult to monitor objectively within the time-frame of our research, evidence from the field suggests that people can see benefits (e.g. better water availability) accruing as a result of their actions, and critically the FLA has empowered users to organise their own environmental and socio-economic monitoring. All of this has been underpinned by the FLA's emphasis on facilitating community-based local institutional arrangements that agree on a set of 'rules' of engagement between users and the wetland and catchment. As well as being developed to manage resource use, many communities have used this platform to self-organise and empower their production and marketing activities.

Conclusions and recommendation

Overall, the FLA has been positively received and our field experience suggests an enthusiasm among communities to engage in developing their own catchment-wetland management plans, based on their own shared knowledge and experience, and within their own local institutional arrangements. Nonetheless, in all cases this has required a fairly significant level of external support, particularly during the early stages of participatory planning and awareness raising. Notably, in some cases the decline of external 'backstopping' post-project intervention has led to a gradual decline in participation in FLA activities, although this also appears to be dependent upon individual socio-economic circumstances.

Improving the framework conditions to facilitate investments in water

Presenting Author: Dr. Astrid Michels, Deutsche Gesellschaft für Internationale Zusammenarbeit, GIZ, Germany

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Keywords

water, energy, susainable infrastructure, climate change

Highlights

- Introduction of greenhouse gas (GHG) reducing technologies to water and wastewater companies
- Support climate protection efforts in the water sector using a cross-sectoral approach known as the urban nexus (water-energy-food)
- Development of strategies for a climate-resilient, low-emissions water sector taking into account all components of the urban water system.

Introduction and objectives

Water and sanitation infrastructure play a major role in the development and growth of local economies. In many developing and emerging countries, water and wastewater utilities are among the largest energy consumers due to high losses of water and energy inefficiency. This will be further exacerbated, as global water demand for water will increase by 55 %, while water availabilty is estimated to decrease by 40 %. Green growth comprises fostering development and economic growth as well as ensuring the continuation of natural assets to provide resources and environmental services on which not only human well-being, but all ecosystems rely.

Methodology approach

The project Water and Wastewater Companies for Climate Mitigation (WaCCliM) aims to improve the policy, regulatory and institutational framework of utilities for the integration of emission reduction measures in the water sector. WaCCliM focuses on the wider dissemination of the urban nexus approach, the support for the implementation of national mitigation strategies and the introduction of appropriate financing strategies. With regards to achieving the SDGs and promoting sustainable infrastructure, an enabling environment that facilitates green investments in the water sector, needs to be created. Such green investments include: 1. Low carbon, climate reslient infrastructure, 2. Sustainable management of natural resources

Analysis and results

The WaCCliM project builds capacity and strengthens public sector institutions to develop green policies and leverage financial resources for a low carbon climate resilient water

At the local level, WaCCliM supports pilot utilities in developing countries and emerging economies to reduce their CO_2-footprint through energy and nutrient recovery, water reuse and water loss reduction.

At the national level, WaCCliM works with policy makers in the partner countries to improve the regulatory and policy framework to strengthen public sector institutions and develop policies for financing and implementing climate mitigation measuer in the water sector. The establishment of frameworks for financing municipal infrastructure is becoming increasingly important. Water funds as well as the strengthening of development banks and the promotion of private investment in the sector improve sustainable infracture. An acceptable legal framwork protects both, the ambitions of the state and the interests of the investor.

At the international level, WaCCliM develops a knowledge platform on climate smart water solutions and scales-up knowledge on water and climate mitigation which favors sustainable infrastrucutre, through the Energy Performance and Carbon Emissions Assessment and Monitoring (ECAM) tool. Effective implementation helps advocate for improved financing mechanisms, and political incentives to replicate the successes of pilot

Conclusions and recommendation

The water sector has many aspects that make a substantial contribution to the presevation of natueral resources and green growth realistic. This requires framework conditions for a sustainable, forward-looking water policy. Best practices on the development of scalable projects that measurably reduce GHGs are disseminated and replication and up-scaling of GHG-reduction approaches on national, regional and international levels promoted.

Increasing infrastructure resilience in New Orleans to enhance environmental protection

Presenting Author: Mr. Laurent Auguste, Veolia, France
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Keywords
resilience, hurricane, scenarios, vulnerability, climate

Highlights
In 2005, Hurricane Katrina caused flooding in 80% of New Orleans, causing raw sewage spills leading to significant ecological damage. To be proactive, the city did a risk analysis of the most critical assets. The vulnerability of the water infrastructure was evaluated using current and future climate risk scenarios.

Introduction and objectives
New Orleans has made it a priority to better understand its exposure to a broader set of future risks, transform its systems and become more resilient. Resilience requires global risk management to optimize prevention costs and reduce post-event environmental, economic, and social losses, and the length of the recovery period. The ultimate solution for this region will be a combination of improved grey infrastructure and leveraged green infrastructure.
The local utility provides critical drainage, wastewater and freshwater services to the city. Failure of these trigger infrastructures would have significant impacts on the City's public health, living ecosystems and global attractiveness.

Methodology approach
30 environmental infrastructure and insurance experts, coordinated with city stakeholders to examine 200 drinking water, sanitation and rainwater evacuation facilities, to determine their degree of vulnerability and to recommend the appropriate action to ensure resilience while reducing environmental impact. The Technical and Risk Assessment delivers a detailed and structured resilience plan, focusing on medium to major risks; improved response and recovery time; and a threat analysis on inhabitant safety, business interruption costs, assets damages and environmental exposure over time. One month of city downtime represents five times the expected annual damage to city assets and biodiversity enhancements.

Analysis and results
Key steps for the project included:
Calculation of baseline exposure of physical assets. Approximately 200 Assets worth $3.4bn (13 WWTP, 132 MGD – 1,600 miles/ 83 Sewage pump stations/ 59 WTP, 146 MGD – 353,000 people/35 Drainage pumping stations, 29 BGD) were
Calculation of year 2050 climate exposure of current assets and ecosystems. More than 150,000 hurricane events were modeled in the Atlantic Ocean and Gulf of Mexico
Tracking and monitoring actions and progress using a tailored Resilience tool. The tool supported local decision-makers by identifying assets' criticality and by modeling a threat analysis to determine priorities and build a long-term adaptation strategy including the level of impact on the environment.
Modeling the impact of selected resilience-oriented improvements on current and future climate scenarios to determine potential cost savings.

Development of a strategic plan to optimize investment funds for risk and cost reduction for taxpayers.
The results of the risk analysis provided the city with a detailed strategic infrastructure and environmental plan with prioritized mitigation measures and the basis for an adapted risk transfer strategy, as well as the necessary tools to monitor the implementation progress and effectiveness of these measures.

Conclusions and recommendation

The results of the risk analysis provided the city with a detailed strategic infrastructure and environmental plan with prioritized mitigation measures and the basis for an adapted risk transfer strategy, as well as tools to monitor the implementation progress and effectiveness of these measures.
Since the existing level of protection in New Orleans following Hurricane Katrina was already high, the most impactful course of action is a two-pronged approach focused on reducing downtime of operations (and therefore negative indirect damage to city ecosystems) and hardening individual assets with the highest reduction in annual expected losses.

Investments in innovative, urban sanitation infrastructure: Decision-making in Sweden

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Keywords

source-separation, wastewater, decision-making, nutrient recovery, energy recovery

Highlights

Highly ambitious sustainability profiles and systems investigations have guided decision-making process in Helsingborg and Stockholm, leading to construction (currently on-going) of a sanitation system with three separate pipes for the blackwater, greywater and ground kitchen waste flowstreams in H+ and a similar approach under investigation in Stockholm Royal Seaport.

Introduction and objectives

Two urban development areas in Sweden with very high sustainability profiles are H+ in Helsingborg and SRS in Stockholm. Systems investigations, including e.g. systems' analyses, legal studies, cost-benefit analyses have guided decision-making process in respective areas, leading to construction (currently on-going) of a sanitation system with three separate pipes for the blackwater, greywater and ground kitchen waste flowstreams in H+ with concurrent separate treatment of each flowstream, whereas a similar approach is under investigation in SRS. Separate collection and treatment of different flowstream increases the possibility for heat recovery from the greywater, increased biogas production and reuse of nutrients.

Methodology approach

In the seminar we will describe the two urban areas from a (i) sustainable infrastructure perspective focusing on sanitation, (ii) the decision-making processes in each example, exemplified by results obtained throughout the investigation periods, including e.g. cost-benefit analyses, heat recovery, (iii) financing of the investments.

Analysis and results

Both cities have a political decision to test sources separating wastewater systems in their environmentally profiled areas SRS and H+. Policies and goals have been formulated, for SRS, the goals were formulated already in 2010, whereas for H+, an investigation process was allowed to formulate more specific goals that were set in 2013. The investigation results show e.g. higher benefits, such as increased potential to recover energy, nutrients and water, and decreased climate emissions. The technical investigations show that the complexity of the infrastructure is comparable to conventional systems and the additional cost is marginal. The initial preparatory and investigation phases were managed in a similar way, in the case of Helsingborg, by the H+ Project office with human resources from different city administrations, and in Stockholm by the City's Development Administration. Stockholm has not yet taken a full implementation decision. In Helsingborg the decision was taken in 2013. The success of the H+ project is due to having established common vision through a cross-sectoral collaboration. The involvement of key-stakeholders and the support from top-management as well as a team driven by curiosity and ability to think out-of-the-box has been instrumental in the process.

Conclusions and recommendation

- Separate collection and treatment of blackwater and greywater have higher benefit-to-cost ratio than BAT for conventional treatment (Swedish setting), hence representing urban, green infrastructure.
- Planning and implementation of this urban green infrastructure demand a stronger relationship and cooperation between the city planners and the water utility than necessarily exists today.
- This shift towards urban, green infrastructure will shift costs and benefits between actors (e.g. heat recovery possibilities). This acts as a conserving force of the conventional approach, demanding an eagle view of the implementation with an actor with the mandate to steer the development towards implementation of urban, green infrastructure.

Modeling the green-grey tradeoff in the Niger River Basin

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Keywords
Niger River Basin, Modeling, Hydropower, Inner Niger Delta

Highlights

- A novel modeling framework can better incorporate green infrastructure into traditional river basin models
- Climate change affects grey and green infrastructure negatively
- To ensure optimal benefits from grey infrastructure development, reservoir releases need to support flow demands of the Inner Niger Delta

Introduction and objectives

In a river basin context, water, food, energy, and environment comprise a coupled natural-human system where natural processes and human behaviors, while recognised as interdependent and dynamic, remain poorly understood. The Niger River Basin in West Africa is such an interactive system, where the urgent challenge of infrastructure development to meet growing water, food and energy demands, also requires the maintenance of environmental sustainability. This paper uses a coupled agent-based—hydrological model to understand tradeoffs between increased hydropower and irrigation infrastructure development and impact on green infrastructure.

Methodology approach

We develop a novel two-way coupled Agent based-SWAT model to assess tradeoffs between grey (irrigation infrastructure and hydropower generation) and green infrastructure in the Niger Basin. We define 'agents' as geographical regions with similar hydrological characteristics and administrative structures. Individual agents can alter parameters in the crop production and reservoir modules in SWAT, to reflect real world adaptive human decisions. We then test different climate and socioeconomic scenarios.

Analysis and results

We find that construction of new grey infrastructure increases the probability that hydro-ecologic indictors will fail meeting targets in areas of fisheries hotspots. Similarly, the development of new irrigation infrastructure affects green infrastructure outcomes. Changing priority between green and grey infrastructure does not alter outcomes substantially as infrastructure construction is limited in the basin, but if planned infrastructure is built, then ecosystem health will be substantially affected. Climate change, in general, has a negative effect on all three sectors while temperature increase affects in particular irrigated crop production and precipitation decreases affect hydropower generation. Climate stress test results show that dam development has the potential to partly mitigate these negative effects, but ecosystem health would still be adversely impacted.

Conclusions and recommendation

To ensure that green infrastructure can be maintained during rapid economic development with grey infrastructure development requires incorporation of green infrastructure needs during project design and operations. However, it is unlikely that all adverse impacts can be avoided.

Natural and built infrastructure can co-deliver basin development

Presenting Author: Dr. James Dalton, International Union for Conservation of Nature, IUCN, Switzerland
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Keywords
Natural infrastructure, trade-offs, climate change, ecosystem valuation, political economy analysis

Highlights
Tracking natural and built infrastructure costs and benefits (economic, ecological, engineering and social) and their trade-offs under plausible climate change scenarios helps decision-makers better design natural and built infrastructure interventions. A political economy lens helps further target accessible financing channels to promote investment in natural infrastructure for sustainable basin development.

Introduction and objectives
Built infrastructure brings essential services: energy supply, irrigation for food production, water supply and flood protection. However, historically infrastructure planning has often ignored the environmental, social and cultural consequences of development. Recognising, valuing and investing in natural infrastructure of river basins enables sustainable green growth. Tracking the multiple quantitative benefits of both natural systems and built infrastructure allows us to optimize mixes of interventions that both maximise and balance the allocation of resources to enable economies to prosper sustainably.

Methodology approach
The WISE-UP to Climate project approach combines multi-criteria and multi-sector assessment of benefits and costs with engagement of basin stakeholders to meet basin needs under various plausible climates. A multi-disciplinary approach bridging the natural and social sciences better reveals the value and role that natural infrastructure can play in sustainable development. Stakeholder engagement is initiated right from project start, helping to guide and validate results and build ownership and cooperation.

Analysis and results
Trade-off analyses in the Volta and Tana River basins demonstrates the value of combining natural and built infrastructure in development plans and of considering different future climates. Natural infrastructure not only provides benefits to people and nature but also to existing built systems. A political economy analysis has unpacked this evidence to identify drivers for change in decision-making and potential 'entry points' for integrating investments in natural infrastructure.
In Pwalugu, on the White Volta River, Ghana, the quantification and valuation of the benefits of natural infrastructure highlights local level dependency on the timing and quantity of river flow, essential for sustaining livelihoods. Despite the potential impacts of a proposed dam to these benefits downstream, trade-off analysis indicates that a balanced natural and built solution is possible. In the Tana River basin, Kenya, WISE-UP research has demonstrated that natural infrastructure contributes to the performance of existing built infrastructure in the basin; improving irrigation and hydropower production and supporting water supply to Nairobi. By regulating upstream river flows and reducing soil erosion, through the implementation of sustainable management practices, reservoir yields are enhanced and hydropower and irrigation benefits safeguarded, under both current and future climatic

Conclusions and recommendation

Natural infrastructure is a vital national asset that supports livelihoods, sustains economic development and helps climate change adaptation. However, in many countries globally, natural infrastructure remains undervalued and poorly recognised at the national level. Tracking the benefits from natural and built infrastructure helps to balance and enhance benefits in the basin. Because such mixed portfolios imply benefit trade-offs, these need to be negotiated through transparent and inclusive decision-making processes involving a range of stakeholders. The WISE-UP approach provides methods, tools and stakeholder engagement which together highlight the social, economic and environmental value of synergistic portfolios of built and natural infrastructure.

Promoting pathways to guide investment in sustainable, resilient water infrastructure

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Keywords
ecosystems, infrastructure, financing, sustainability, economics

Highlights
Long-term strategic planning for water infrastructure investments, which considers green infrastructure options, can maximise the benefits of these investments and ensure they can adjust to changing conditions. New financing models for green infrastructure demonstrate how the benefits from these investments can support sustainable financing.

Introduction and objectives
Water infrastructure is typically very long-lived and capital-intensive, so ensuring investments can cope with considerable uncertainty (due to climate change, economic and demographic trends) is especially challenging. This requires long-term strategic planning of investment pathways that systematically consider green infrastructure options, which may be more cost-effective and flexible to adjust to changing conditions than conventional 'grey' infrastructure. It also requires carefully considering how pursuing a specific project may foreclose future options or inadvertently increase vulnerability to water risks. Emerging experience with new financing models for green infrastructure can help convert the benefits from these investments into revenue streams for investors.

Methodology approach
This analysis draws on on-going analytical work by the OECD focused on promoting pathways for strategic water infrastructure investment, building on country case studies. Examples of new financing models for green infrastructure also benefits from structured discussions with water experts and the experts from the finance community (development finance institutions, institutional investors, commercial banks, asset managers, venture capital firms) in the context of the OECD-WWC-Netherlands Roundtable on Financing Water.

Analysis and results
While financiers are typically focussed on the availability of a pipeline of 'bankable' projects, governments should also situate these pipelines within broader strategic investment pathways that contribute to water security and sustainable growth over the long term. 'Green' (or 'nature-based') infrastructure, such as catchment protection, can result in substantial avoided costs and a wide range of benefits. Such schemes may have modest funding requirements (despite high benefits), but due to the long lag times for benefits related to changes in land use to materialise, a long-term strategy is needed.
Green infrastructure can be used in combination with built infrastructure and should be considered in early stages of designing water investments. Analytical tools are needed to identify the trade-offs between green and built infrastructure and understand how the benefits of these investments can be converted into the revenue streams to support their financial viability.

Dedicated finance facilities can be used to scale up investment in natural capital projects with ad-hoc structured finance solutions for projects focussed on protecting public goods. Such a dedicated facility allows for patient investments with longer tenors than otherwise available.

Conclusions and recommendation

The analysis provides valuable insights for policy makers, NGOs and financiers (development finance institutions, institutional investors, public funding agencies, commercial banks, etc.) to develop and scale up approaches for financing green infrastructure. The analysis also provides insights for governments on how they can move beyond a short-term focus on project pipelines to long-term strategic planning for pathways of investment for water security and sustainable growth.

Smart web-based IT solution for planning of sustainable subsurface infrastructure

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Keywords
smart IT, nature-based infrastructure, managed aquifer recharge, water management

Highlights

- Managed aquifer recharge (MAR) is a viable close-to-nature infrastructure
- The shift from economic and ecological costly infrastructure requires technical innovation and smart IT solutions
- INOWAS DSS is a web-based modeling platform for planning, assessment and optimization of MAR applications

Introduction and objectives

The development of nature-based infrastructure requires the rethinking of existing solutions and development of new, innovative approaches for water resources management. The traditional practices include almost exclusively horizontal, above-ground solutions, often with extremely high financial and ecological costs. The novelty of the concept presented consists in shifting the focus on the highly unexploited vertical dimension of conjunctively using the subsurface for water storage, treatment and transport. Natural subsurface infrastructure, if properly designed, can smoothen the highly irregular spatial and temporal discrepancies in water availability and increase the sustainability of urban and rural development.

Methodology approach

Despite their demonstrated economic and ecological benefits, solutions such as managed aquifer recharge (MAR) are still not widespread, partly due to poor access to information and lack of knowledge. The shift from horizontal to vertical water management requires technical innovation and the development of smart planning tools. The INOWAS Decision Support System (INOWAS DSS) fills these gaps by providing a free, web-based modeling platform for planning, assessment and optimization of MAR applications. The system provides smart modeling tools of various degrees of complexity which makes the platform accessible to multiple groups of stakeholders.

Analysis and results

With few exceptions, all available software and decision support systems for water management are desktop-based, which represents a significant constrain in the development and dissemination of smart IT solutions to a large audience. The INOWAS DSS is developed as an open source web-service where modern design elements are combined with powerful server capabilities to guarantee comfortable modeling experience and reliable simulations. In comparison to desktop-based software, the whole workflow is managed directly in web-browser without the need to install additional plug-ins. The web-based implementation allows multi-user collaboration via internet, bringing a global perspective to water resources management. The potential direct collaboration between researchers and decision-makers simplifies the communication and makes the information quickly available everywhere is needed. A flexible project management allows users to work on private, public or shared tasks while the work progress can be saved at any stage and resumed later. Among the tools included are databases and tools derived from data mining (for example the global inventory of MAR applications), simple tools based on analytical equations, and numerical tools for the calculation of groundwater flow models. The user-friendly scenarios management and analysis allows for a flexible interpretation of results and future predictions.

Conclusions and recommendation

The free, web-based INOWAS DSS platform supports planners and decision makers in different steps of planning and assessment of MAR applications. The web-based implementation offers a whole new range of opportunities for collaboration while the multi-layered toolbox complexity makes the platform easily accessible. With its technical innovation, the INOWAS DSS is expected to actively contribute to the promotion and expansion of MAR applications, therewith supporting the shift to vertical groundwater-based natural infrastructure solutions. The platform can be accessed at https://inowas.hydro.tu-dresden.de.

Tracking sustainable infrastructure with near real-time comprehensive assessments

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Keywords

Ecosystems, Near Real-time Assessment, Sustainable Infrastructure

Highlights

- COMPASS is an innovative combination of scientific knowledge, and information technology that detects, evaluates and reports on water resource challenges around the world in a real-time framework at global and sub-global level.
- COMPASS is a principal contribution of the science community to anticipatory planning at all levels of government

Introduction and objectives

A new, 'blended engineering', combining traditional grey with green approaches could provide a cost-effective path to human water security. COMPASS developed by Water Future, UNESCO-WWAP, CUNY, and other partners, identifies areas where grey infrastructure in combination with natural infrastructure can jointly help to support the maintenance of ecosystem services and benefit the population. Such dynamic real-time assessment toolbox is an unprecedented step from the science and digital information community to assist decision and policy makers at different scales in real time, and helps to maximise the impact of their policies and decisions.

Methodology approach

COMPASS collates spatial maps and real-time data to produce retrospective and near-real-time assessment of the state of the global water resource base (2010-present) at a higher resolution than has been done previously, i.e., at 3' (latitude/longitude; ~6 km). It is casted as a suite of metrics represented as a time series, which can be aggregated into an overall water resource system behaviour metric. It is a combination of human dimensions (including socioeconomic indicators) together with a biogeophysical water resource measures. The level of detail in COMPASS goes well beyond national boundary aggregation, with the integration of state-of-the-art geo-databases

Analysis and results

COMPASS has already produced results which predicts a heavy reliance on traditional engineering to achieve Human Water Security for the remainder of the century. With economic expansion and population growth, global expenditures on hard infrastructure and operations will triple over the next 50 years. Relative increases are most rapid in the developing world mainly in China, India and the non-OECD states. COMPASS also predicts the role of Green Infrastructure spatially at a much finer scale that can reduce the threat to human water security, and finds how the benefits of Green Infrastructures varies from the region with a dense population (low) to remote parts of the Globe (High). Also, COMPASS spatially identify the areas (including upstream protected areas) where combined impact of grey and green infrastructure is higher and suggesting an important role for natural capital in global water security threat containment.

Conclusions and recommendation

While traditional engineering approaches (often referred as grey infrastructure) without question yields immediate benefits in addressing a target water problem, results suggest that typically incur higher fixed costs, often outstrip the technical capacity of many nations to operate and maintain them, and in many cases destroy the environmental systems (green infrastructure, ranging from wilderness to managed or protected watersheds) that serve as the foundation or source for renewable water supplies. A new, 'blended engineering', combining traditional grey with green (ecosystem-inspired) approaches represents an important opportunity space within the overall sustainable development agenda.

Water for the city: 'Greening' grey infrastructure and engaging stakeholders

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Keywords

Water, urban, holistic, dam, sustainability

Highlights

'Water for the City' (WfC) project highlights:

- Greening of grey infrastructure, namely optimisation of existing water supply dams, with multiple environmental and socio-economic benefits
- Stakeholder engagement introducing planning for green-blue infrastructure towards integrated urban water management in a climate change context
- Education for a new water culture.

Introduction and objectives

WfC was designed by Global Water Partnership–Mediterranean through a multistakeholder approach and is implemented in collaboration with the Alexandroupolis Municipality, N.Greece, and the Alexandroupolis Municipal Enterprise of Water Supply and Sanitation, with the financial support of the Coca-Cola Foundation. WfC has a two-fold aim: increase urban water supply and promote sustainable water use among stakeholders. A technical application, i.e. the installation of freestanding gates on the local water supply dam, increases reservoir capacity by approx. 14 %. At city level, educational, awareness raising and capacity building activities engage, train and inform stakeholders and the local community.

Methodology approach

Responding to increasing water supply needs in the Alexandroupolis metropolitan area, the technical application on Dipotamos dam spillway increases reservoir capacity through a relatively small intervention in terms of size, cost, implementation time and environmental impact, as the potential water rise level has minimum environmental nuisance according to the environmental impact assessment addendum. Furthermore, increased reservoir capacity enables less use of coastal aquifers, and mitigates salinization risks and energy demand for water abstraction; it allows the water supply network's expansion to neighbouring areas and contributes to avoiding investment in new costly large-scale infrastructure with multiple environmental impacts.

Analysis and results

Creating a new urban water culture and rationalizing water demand, by introducing green-blue infrastructure, non-conventional water resources and water efficiency options at city level is a key component of the project. WfC engages authorities and stakeholders, educates students and educators, and raises public awareness on the urban water cycle and efficient water use. Capacity building for local authorities and key stakeholder groups, including the private sector and civil society, is achieved through a serious game that promotes integrated urban water management focusing on strategic planning in the context of climate change uncertainties. This role-playing board game serves as a tool to engage participants and introduces them to multiple conflicts in urban water management and future challenges, while improving communication among stakeholder groups with diverse interests. At the same time, innovative and contemporary educational and communication activities reach out to the educational community and citizens to facilitate the creation of a new water culture, respectful of natural resources, aiming at sustainable development and growth. Overall, this multi-stakeholder project with its holistic approach leads to multiple benefits, it is consistent with the water-energy-ecosystems nexus approach and the nature-based solutions 'umbrella concept' and contributes to long-term sustainability of water resources in coastal Alexandroupolis.

Conclusions and recommendation

Through the application of an innovative technical solution that increases the capacity of the local water supply reservoir with minimum intervention, as well as through the multi-stakeholder partnership approach where local authorities, the civil society and the private sector contribute to the successful implementation of the project, WfC seeks to engage local partners and citizens in the sustainable use of water and aspires to become a successful paradigm to be replicated elsewhere in the world, adapted to the specificities of different areas, geographically and culturally.