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Seminar: Ecosystems in an urbanising world: Challenges and opportunities for symbiosis

ABSTRACT VOLUME

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Seminar: Ecosystems in an urbanising world: Challenges and opportunities for symbiosis

Contents

Accra's groundwater: a strategic resource for improved (peri-) urban resilience

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Keywords
Groundwater, resilience, urban transition, MAR

Highlights

- For poor urban households, resilience is a matter of ensuring water access from different sources, for different purposes;
- In stressed urban water scenarios, diversification is vital to spread risks and improve preparedness;
- Managed aquifer recharge and groundwater source protection form the backbone of conjunctive use.

Introduction and objectives

With increasing pressure and impacts from population growth, urbanization, climate change, etc., the ecosystem services that aquifers in (peri-) urban areas provide are fundamental as water reservoirs and buffers. Accra and its hinterland exemplify an African city with chronic water shortages, where groundwater resources offer opportunities to improve resilience against recurring droughts and general water insecurity. However, this case study is not a conventional success story. Rather, it shows how flexibility and resilience has decreased due to planners and decision makers focusing single-mindedly on expanded raw water intake from a river, dismissing groundwater as inferior and a transient phase.

Methodology approach

As part of the Unlocking the Potential of Groundwater for the Poor (UPGro) research programme, this paper investigates the role of groundwater as a strategic resource, for households' coping with inadequate drinking water services, and for a city's short and long-term planning to improve resilience to water shortage and periods of drought. It builds on a case study of Dodowa, a low-income township on the outskirts of Greater Accra, Ghana. Primary data were collected using a mixed-methods approach, including observations in situ, semi-structured, open-ended interviews with residents, the public water utility, the District Assembly and others, and a survey (n=300).

Analysis and results

The literature highlights the importance of a city leaving behind the idea of being self-supporting on water, and the risks associated with relying heavily on an engineering, technology-driven conceptualization of resilience, pointing instead to how attempts at managing variability to reduce vulnerability may lead to lock-in with large-scale infrastructure such as dams. Further, scholars stress that the 'water security' dialogue must be better informed about groundwater, to attain the SDGs. Though groundwater is the major source of drinking water in sub-Saharan Africa, its 'invisible' character does not easily lend itself to inform policy for the building of resilience. The demonstrated benefits of managed aquifer recharge are key to reduce a city's vulnerability to and impact from water insecurity.

This study finds that the groundwater dependence in Greater Accra holds important transformation insights and provides lessons for planners and decision makers to re-think the business as usual-approach. Better

coping preparedness can be modelled on recognizing how end-users respond to poor piped water supply as well as to other types of changes and sudden events. The longevity of groundwater resources as part of a natural system must be governed in combination with human systems for allocation and conservation decisions.

Conclusions and recommendation

For end-users, particularly poor urban households, resilience is an every-day matter of ensuring access from different sources, for different purposes, while attention to drinking water safety is falling behind. Increasing needs for drinking water safety call attention to contextually fit groundwater treatment methods. Planners and decision makers should take their cue from how households have developed coping mechanisms by diversifying, and move away from the focus on large infrastructure and centralized water supply solutions. Conjunctive use, managed aquifer recharge, and suitable treatment measures are vital to make groundwater a strategic resource on the urban agenda.

Developing urban water ecosystem sustainability indicators: water ecosystem health assessment

Presenting Author: Dr. Uttam C. Sharma, Centre for Natural Resources Management, India
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Keywords
Urban water ecosystem, Sustainability indicators, Health assessment, planning and management, Jammu city

Highlights
Competing water demands impose difficult allocation decisions and limit the expansion of sectors critical to sustainable development of cities. Disruption of ecosystems through unabated urbanization undermines the environment's capacity. Urban water ecosystems indicators developed for health assessment of Jammu city of India helped in judicious planning and its sustainable growth.

Introduction and objectives
Indicators are tools of information, which summarize important properties, visualize phenomena of interest, quantify trends and communicate them to relevant target groups. Urban water ecosystems (UWE) perform functions like water supply for production and cleaning, removal of fecal matter, handling of wastewater, drinking water provision, prevention of flooding by drainage water etc. Rapid urbanization in and around Jammu city of India face a range of pressures including unplanned growth and unmet demand for basic services, as well as increased water consumption, waste generation and water discharge. The study was undertaken to assess UWE status and improve it for better services.

Methodology approach
The study place is the city of Jammu city of India having a population of about 1.1 million. The major factors considered for UWE indicators were; status (source and quantity of water bodies), quality (extent of pollution), dimensions of sustainability (environment, society and economy), economic accounting (environmental good as and services are valuated in monetary terms), biophysical (natural resources required to perform certain economic activity or to sustain a national economy), resource and material (stocks and flow paths of resource/material along all the uses into certain boundary), and pressure (causal chain of a particular effect considered as negative for sustainability).

Analysis and results
Due to scanty rainfall and its biophysical setting, the Jammu city is prone to water shortages as most of the rainwater goes down the drain without proper usage. By developing UWE norms, five major causes of worry solved for Jammu are; system boundaries, objectives, time frame of projects, external pressure and, needs and interest of stakeholders. The boundary of a system under analysis will significantly influence the final result of an assessment and the solution devised. Most of system boundaries are focused on the main infrastructure. However, such approach might not represent fully the water flow in the city. When city areas are not covered or there are problems of low maintenance or high tariffs, urban dwellers organize complex means to acquire water, dispose fecal matter and deal with floods. Other water sources, practices and other systems were then developed. It means that design and selection of indicators become a space where those differences need to be settled. Persistent poverty, inequitable access to water supply and sanitation services,

inadequate financing, and deficient information about the state of water resources, their use and management impose further constraints on water resources management and its ability to help achieve sustainable development objectives.

Conclusions and recommendation

Water ecosystem services are a crucial part of sustainable urban development. They contribute to resilience against disasters, regulate temperature, improve food and water security, absorb pollution, contribute to livelihoods and addressing poverty. The strong linkages between urban quality of life and how cities use and manage natural resources becomes essential in having integrated approaches to sustainable urban development. If managed well, urbanization can create employment and prosperity, and become a central driver for eradicating extreme poverty and for strengthening social inclusion. Development of UWE norms for Jammu city has helped in proper planning and judicious management of resources.

Floods find their own path: A case study from Kelani

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Keywords

wetlands, flood risk reduction, sustainable development

Highlights

Wetlands provide significance ecosystem services in flood resilience. When wetland habitats are filled up and converted to other uses with increased impervious surfaces and loss of connectivity, risk of flood damage increases. Thus, wetland conservation should be incorporated in sustainable development agendas specially in urban management.

Introduction and objectives

Wetlands act as natural infrastructure in flood disaster mitigation with no cost of building and maintenance. Nevertheless, in many urban areas wetland habitats are rapidly shrinking due to population growth and expansion of developmental

Kelani river is a key water body in Sri Lanka which flows through the highly populated Colombo district. Substantial and rising impacts of river floods have caused many socioeconomic and environmental implications in the recent past. In this study, we hypothesized that the land use changes, specially shrinking of wetland habitats in the area, has contributed to flood damage.

Methodology approach

This study was carried out in Kolonnawa and Kaduwela areas in the lower reaches of the Kelani river basin to determine the land use changes in the previous four decades up to 2016. Several filed visits were made for ground level verifications and flood damage data were obtained from local authorities. The effects of land use features on flood occurrence have been determined by using GIS and remote sensing. Areas represented by major land use types (including built environment, home gardens, wetlands and marshes) were studied and the change of each category was calculated by using geometric calculations.

Analysis and results

The current study reveals the following significant facts:

a) The study area has undergone tremendous changes in relation to transformation of landscape from natural (wetlands, marshes, bare land) to built up areas (buildings, roads).
b) Nearly 50 % of the natural and man-made wetlands has disappeared due to encroachment, filling and conversion to built up areas during the last 4 decades and connectivity between many such habitats too were lost.
c) Most interestingly, in the last two decades when the river flooded, water has flown to all the areas where wetlands were once existed and at present under built up
d) The results demonstrate that filling up of wetlands has contributed to increased flood damage.

Conclusions and recommendation

The results of the present study illustrate the risks of filling up, encroaching and building over wetlands in the low elevation areas. It also highlights the benefits of maintaining healthy wetlands which can be readily included in developmental plans to enhance urban resilience to flood disasters. Thus, the findings of this research provide impetus for integration of wetland management in urban landscape planning to enhance natural defenses against flood disasters.

Integrated approach for Blue/Green Infrastructure management in urban areas

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Keywords
Blue/Green Infrastructure, Citizen Science, Ecosystem Services, Integrated Water Management

Highlights
A global citizen science programme in 18 major cities, addressing the twin challenges of urbanisation and climate change, provides us the possibility to show how a participated and integrated approach to aquatic ecosystem management has benefits on individual and community well-being, livelihoods, education, social interaction and regulatory capacity.

Introduction and objectives
Climate change and urbanisation are global trends that have linked causes and effects. As the world's population becomes urban, new approaches are required that follow a more integrated and participated process to address both these causes and their effects. We show the results of a global citizen science programme supporting innovative and integrated urban design and management in Asia, Europe, Americas and Middle East. We will explore the benefits and costs of creating more participative approaches on urban ecosystem management and policy.

Methodology approach
Citizen scientists are working with local scientists, policy and planning institutes to explore novel ecosystem approaches to urban design, planning and the creation of more sustainable cities through an ecosystem based approach. We use an interdisciplinary methods to quantify and qualify ecosystem services provided by urban blue and green infrastructure for the local and wider urban community. Each project brings together private partners, citizens, policy and planning institutes and leading scientific partners to address the multiple and far ranging aspects of sustainable cities. Working across climate, cultural and socio-economic ranges allows for new insights into the possibilities of urban sustainability.

Analysis and results
Our preliminary results indicate that this participative approach has benefits for the scientific community, regulatory agencies, policy institutes and planning agencies, and most importantly, on the participants themselves. Through the efforts of trained and enthusiastic citizen scientists, scientists are shown to have an increased capacity to identify key trends in urban ecosystem dynamics, with an average return on time invested in training of nearly 4:1. By increasing both spatial and temporal coverage of key ecosystem services indicators, scientists can better support innovative ecosystem based approaches to key urban challenged related to flooding and drought, nutrient and carbon dynamics and urban heat island effects. These activities are conducted with the support of policy and planning agencies as well as regulatory partners. Efforts by citizen scientists are shown to support regulatory agencies, increasing their capacity to gather fundamental ecosystem information, across a more complete range of ecosystems and with an increased tempestivity with regard to extreme events. For planners, the participation is show to increase citizen scientist's awareness of urban tipping points and their support for more sustainable policy and planning approaches.

Participants show an increase in engagement with local actors and positive benefits on their personal and institutional sustainability.

Conclusions and recommendation

This programme and its sister projects allow us to analyse the costs and benefits of recruiting, training and engaging citizen scientists to promote ecosystem approaches and demonstrate their benefits to urban management and planning. Increasing the participation of this growing community of urbanites in the study and stewardship of their local environment is a major opportunity to promote more integrated approaches to urban management, basic to meeting the SDGs.

Integrating Green Infrastructure in Dense Cities of the Global South

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Keywords
Green infrastructure, Human Settlements, Water treatment, Drainage, Participatory planning

Highlights
The research analyses green infrastructure designs for drainage and wastewater management. It focuses on low-income settlements, with Latin American and African case studies, and thereby emphasises poorly understood planning challenges in these contexts. It particularly discusses participatory tools to consider residents' needs, juxtaposed to governance systems for green infrastructure development.

Introduction and objectives
Green infrastructure has attracted global interest for implementation of nature-based solutions in cities. This research aims to take the concept of green infrastructure a step forward. It recognises that the pursuit of greening strategies may conflict with other urban development priorities, including that of poverty reduction. It discusses integration in low-income, dense settlement contexts, thereby bridging ecological and social agendas for resilient cities in the Global South.
The objectives are to: 1) evaluate green infrastructure design techniques for drainage and wastewater management at community scale; 2) understand participatory practices enabling to better consider spatial tensions, and to engage with stakeholders.

Methodology approach
Although still largely misunderstood, challenges of ecosystem development in cities greatly lie in spatial planning and social inclusion. Adopting a political ecology approach, the research explores ways to break exclusionary patterns in urban planning. It evaluates urban green infrastructure practices through the following steps:

- Review case studies of green infrastructure implementation approaches for low-income settlements in São Paulo (Brazil) and Durban (South Africa);
- Analyse designs optimising the use of space while improving drainage and wastewater management through the concept of slum networking;
- Analyse engagement with slum dwellers for green infrastructure design and implementation based on participatory methods.

Analysis and results
From an engineering perspective, the review highlights the lack of research conducted on green infrastructure in tropical climates. In urban planning, it shows poor empirical evidence has been gathered on integration for the benefit of slums dwellers. This also emphasises the lack of institutional capacity for development and planning of informal settlements.
The São Paulo case study demonstrates that comprehensive GIS data analyses and mapping enable to meet design objectives, including that of water efficiency and flood mitigation, while considering socio-economic factors. A range of technical and design expertise requiring interdisciplinary approaches have led to the design of a network of solutions including permeable pavements, rain strips and bioswales which are

analysed as implementable in favelas. Further engagement is however required to comprehensively integrate residents' opinions on the extent to which these meet their needs.
The case of Durban which aims to implement closed-loop water systems using wastewater for urban agriculture emphasises the value of community engagement to capture residents' perceptions, attitudes and knowledge of the local environment. Potential for urban farming through such techniques was validated through focus group discussions were participants responded positively, recognising space constraints but identifying value in income revenue at both individual and communal scale.

Conclusions and recommendation

In order to overcome the challenges of balancing compactness and ecosystem development while meeting populations' demands in cities, tensions between social and ecological agendas over spatial planning must be better considered. The research participates in building a case study database to inform future practice. Participatory approaches are recognised in NUA as essential for just urban planning. Aligning with this purpose, the research shows mapping stands as a tool to contest, engage and include. If green infrastructure must lead to 'win-win solutions', then its design and implementation must consider these factors, in a manner it is adapted to local interests.

Integrating land use and water management planning with multicriteria analysis

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Keywords
Land, water, ecosystem, integration, planning

Highlights
Due to current pressures of population growth and urbanization is urgent the need of integrating land use and water resources planning with an ecosystem approach. This integration is effective by the application of a Multicriteria Analysis (MCA). The results were applied by the stakeholders in plans for the city of Quito.

Introduction and objectives
The pressures of population growth and urbanization are urging attention to the relationship between where and how people live and the water they need. Strategies are arising to integrate land use and water resources planning that will allow decision making based on the appropriate connections. The aim of this work is the design and application of a Multi-Criteria Analysis (MCA) model that allows the qualification of key interacting factors and elements for water management and land use planning under an ecosystems framework, determining the levels of relevance of the integration categories in order they should be given the corresponding consideration.

Methodology approach
This study has a qualitative and quantitative approach, starting with the definition of land use and water resources integration categories and the criteria and subcriteria for valuing them. The ecosystem based criteria, as the required or existing information and plans, and socioeconomic and environmental feasibility, reflect the values associated with the consequences of each water and land use integration categories, as water supply assessment and development, regional structures, and growth management. Once the integration categories and the criteria have been defined, weights and scores are assigned to derive overall values and ranking by a MCA, that includes a sensitivity analysis.

Analysis and results
The integrated consideration of water resources and land use subsystems with an ecosystem approach contributes to sustainable development and water sustainability, identifying key variables of the subsystems that have to be given prioritized attention in order to reach an effective integration, assuring these elements are not left out or would be given minor attention. With the large number of elements considered, a large number of combinations of potential management actions is possible, being fundamental the application of a multi criteria decision making tool.
In the MCA model applied to prioritize the strategic components of water and land use integration categories for the case of the Metropolitan District of Quito, the scores obtained by valuing the expected performance of each integration component against the criteria, represent their level of relevance according to the corresponding scores. The results of ranking land and water integration categories for Quito are: 1) Water Supply Assessment/1580. 2) Water Supply Development/1547. 3) Regional Structures/1448. 4) Comprehensive Planning Efforts/1410. 5) Growth Management and Densification/1323. 6) Rate Structures/1319. 7)

Education/1272. 8) Resource Use Efficiency/1021. The results of the sensitivity analysis carried out demonstrate that the structure of the model is sensitive even to minor variations of input values.

Conclusions and recommendation

The ranking of land and water integration categories according to the corresponding scores of the MCA application, determines the relevance of the integration components. Since all the site specific water and land use integration categories must be considered when formulating land use plans under an ecosystem framework, a MCA is an adequate tool to determine their specific level of relevance based on the assigned values. The application of the model to the city of Quito allows the optimization of technical and financial resources and set priorities related to the timely implementation of water management actions when planning for land use.

Is really ecosystem development hand in hand with urbanization?

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Keywords

Urban ecosystems, Development, Hesitant decision-making, Analytic hierarchy process

Highlights

- Serbian City of Novi Sad is experiencing problems in managing its ecosystems.
- Urban ecosystems are affected by inadequate institutional organization and societal behavior due to inadequate distribution of fresh water to residents.
- Participative decision-making framework is required to motivate residents to work hand in hand with institutions.

Introduction and objectives

Green spaces in Novi Sad City (Serbia) provide a variety of physical, psychological, and social benefits to residents. Institutional organization is inadequate for sustainable development of city parks because manageable factors which influence people's health and wellbeing are not well recognized. Research indicated possible improvements in maintaining parks, distribution of fresh and purification of polluted water, fostering resilience of ecological systems, and reducing and protecting the environment. We developed scoring and aggregation schemes and interpreted experts' judgments to define priorities in preservation (management) and future investments into green areas.

Methodology approach

Earlier research indicated need to more explicitly relate urban and ecosystem development indicators with management of city parks, i.e. to quantify their mutual impact and trace the road toward synergy. We created participative decision making framework and used hesitant analytic hierarchy process (AHP) methodology to derive priorities of indicators. Such quantification enabled more focused discussion and reaching consensus between experts about recommendations to be given to the city government on how to harmonize urban and ecosystem development. Applied methodology is adequate because it manipulates qualitative and quantitative decision elements, commonly expressed in non-commensurate units.

Analysis and results

It is well known that city parks in multiple aspects influence health and wellbeing in the city and positively impact quality of life of its residents. For instance, urban ecosystems are functionally and directly connected with fresh water availability and distribution, but also connected with less measurable 'ecological culture' of citizens and their willingness to organize themselves and participate in societal and political processes important to consolidate (where necessary) and help to harmonize overall urban development. Several decision makers from academia and professional organizations applied hesitant AHP group decision making methodology to recognize impacts of various parameters which influence development of ecosystems within different city areas. Aggregation of derived values indicated that city urbanization is not clearly connected to ecosystems development. Assumption made in this experiment was that hesitant information is allowed. Based on individual hesitancy experience, experts could represent their judgments by several possible values. We used several indices to control consistency degree and consensus degree of decision makers to preserve

good control of decision making process. The results are encouraging from methodological point of view, as well as quality of results that can be obtained.

Conclusions and recommendation

Urban ecosystem management is multidisciplinary strategic process requiring use of environmental, economic and social tools flexible (robust) when decisions have to be made in variety of situations and unexpected changes in one or more systems. Our research team searched for more explicit relationship of quantity, quality, and accessibility of green urban areas and showed that responsible urban institutions need to adapt to an overall urban context, but primarily to respect interests of citizens as principal stakeholders. Used hesitant methodology assured flexibility in group decision making. It is theoretically sound and easy to implement for reasonably large group of decision makers.

Let nature do the work in the Stockholm Royal Seaport

Presenting Author: Ms. Christina Wikberger, City of Stockholm, Sweden
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Keywords
Ecosystem services, multi-functionality, resilience, climate adaptation, storm water

Highlights
Methods and tools for ecosystem services have been developed and tested in the Stockholm Royal Seaport (SRS), that estimates and studies of ecosystem services as efficient, economical solutions in urban development.

Introduction and objectives
The Stockholm Royal Seaport, SRS, is the largest urban development project in Stockholm with 12,000 new housing units and 35,000 workplaces. The area has an environmental profile and ecosystem services are an important part of the work to create sustainable urban development. One of the strategies of urban development in SRS is to 'Let nature do the work'. By including the R&D project C/O City – on ecosystem services in city planning, tools have been developed and tested in SRS and also spread to other city development areas in Sweden and around the world.

Methodology approach
Three of society's biggest challenges ahead are climate change, the reduces biodiversity, and urbanisation. By planning and creating ecosystem services we can reduce the negative impact on cities and their surroundings. The purpose of the research and development project C/O City has been to highlight the value of nature in the city, to create a planning basis, data and tools, and generate concrete solutions that facilitate the work with ecosystem services in city planning. C/O City has its starting point in the work of the City of Stockholm on the sustainable profile of the SRS.

Analysis and results
The work on ecosystem services and the R&D project C/O City in SRS have resulted in tools to reach the project's ambitious goals and to create a climate-adapted and lush outdoor environment in the area. Methods have been developed, such as the green space index and storm water strategies, and contributed to creating an outdoor environment designed for multi-functionality, such as managing increased rain, balancing local climate, creating pleasant outdoor areas, and reinforcing the ecological connections in the area.Several public enquiries have emphasized the importance of ecosystem services. The Swedish government has decided that by 2018, 'the importance of biodiversity and ecosystem services should be publicly known and implemented in financial standpoints, political resolutions and all other decisions, where ever relevant and reasonable.' The Swedish government is also setting up a subsidy for greener cities. The government has allocated 100 million Swedish crowns for 2018, 500 million for 2019 and 550 million for 2020. The subsidy shall promote increase and development of city greenery and ecosystem services in urban environments.

Conclusions and recommendation

Creating sustainable cities also requires planning for green cities where ecosystem services are used to deal with the challenges ahead.Integrate ecosystem services in planning in order to create sustainable cities, and consider the green-blue infrastructure as necessary in the same way as any other infrastructure. Use methods and tools that systemize and quantify work in order to make the ecosystem services visible. All tools and methods require good interaction and a process with the parties concerned. It is in the process of cooperation that you create understanding, where good ideas develop and support is secured.

NAIAD: Nature Based Solutions in Copenhagen, Rotterdam and Lodz

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Keywords

Disaster Risk Reduction, urban flooding, green and blue infrastructure, resilience, insurance value

Highlights

Co-design and implementation of nature-based solutions (NBS) with involvement of key stakeholders with focus particularly on hybrid blue-green and grey infrastructures aiming to assess insurance value of NBS and build resilience to climate extreme events, illustrated for the cities of Copenhagen, Rotterdam and Lodz

Introduction and objectives

Within the project NAIAD (naiad2020.eu) project, the insurance value of ecosystems for mitigation of water related risks is assessed and tested through the co-design and implementation of nature-based solutions (NBS) with involvement of key stakeholders (including insurers). The objectives are: (1) To provide a robust assessment framework for the testing, data collection and operationalization of NBS; (2) To pilot methodologies in cities (Copenhagen, Rotterdam and Lodz) and co-develop for diverse risk and NBS contexts; (3) To identify and address specific barriers and opportunities for the uptake of NBS and natural assurance schemes policy instruments, business models and innovation

Methodology approach

The city of Copenhagen employs an integrated assessment by a Bayesian Belief Network analysis is performed including input from a dynamic integrated hydrological model. The city of Rotterdam has focus on underground storage and recovery of stormwater runoff to expand the aboveground rainwater retention and save rainwater for irrigation. The city of Lodz focuses on rainwater and river management to cope with the challenge of rehabilitation of 18 rivers to counteract fluvial flooding,to co-create green spaces. All three approaches focus on urban green infrastructure NBS and include methodologies on stakeholder participation, risk perception and economic aspects, including co-benefits.

Analysis and results

The city of Copenhagen presents progress in integrated assessment and employing a Bayesian Belief Network analysis including input from a calibrated dynamic integrated hydrological model (MIKE SHE), set up on a 100 m spatial resolution for the greater Copenhagen area and 10 m resolution for a selected area in the urban part. The role of shallow groundwater in the catchment in general, and as a boundary condition for the urban model is explored. The city of Rotterdam presents the results for the Urban Water Buffer system to be implemented in the Spangen neighbourhood using a local Water Balance Model which will be developed using SEAWAT modelling and Python scripting. The city of Lodz presents progress of developing river management for coping with the challenge of rehabilitation of 18 rivers to counteract fluvial flooding and to co-create green spaces. All three cities present the preliminary results of integration of biophysical modelling, social network analysis and risk perception, system dynamic modelling and economic approaches that support the assessment of the insurance value of NBS in urban context.

Conclusions and recommendation

The anticipated conclusions and recommendations for the three urban Living Solution Labs, Copenhagen, Rotterdam and Lodz, will be based on progress in the development of biophysical modelling, participatory methods, including social network analysis and system dynamics as well as economic assessments to support NBS development and implementation by tailoring such tools to the local environmental, social and legislative conditions. Other outcomes are progress in economic valuation methods, including valuation of co-benefits and development of business models to be developed to empower broader investments in NBS

Non-Sewered Sanitation: for the community, for the environment

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Keywords

Urban sanitation, non-sewered sanitation, gender, water quality, ecosystem

Highlights

The purpose of this research is to identify how the laws and policies across five African countries facilitate or hinder the use of non-sewered sanitation in urban communities. Sanitation laws and policies are essential to supporting a healthy community and environment.

Introduction and objectives

This research examines how the law advances or hinders the adoption of non-sewered sanitation ('NSS') in urban centers. Sewered sanitation - centralized sanitation made up of miles of costly pipes and a centralized wastewater treatment facility - often does not meet the needs of urban communities, especially low-income communities or informal settlements. National-level laws often fail to provide a comprehensive and implementable framework for sanitation and exclude NSS as an option. Ensuring that urban communities property treat their human waste and create value out of wastewater/sludge protects the health of the citizens and reduces water, soil, and environmental pollution.

Methodology approach

The Center for Water Security and Cooperation, with funding from the Bill and Melinda Gates Foundation, is creating the first pan-African water law platform to understand how laws are impacting and influencing water security across all sectors and jurisdictions within and between each country in Africa. We are collecting, cataloguing, independently analyzing, and critically evaluating collected laws to understand the scope and depth of existing water law frameworks. Given the impact untreated sewage has on water quality and human health, sanitation is a priority focus area. Fecal contaminated soils diminish the vibrancy of communities and ecosystem health.

Analysis and results

Our research begins with an examination of sanitation laws broadly, focusing on the management of domestic and industrial liquid waste (excluding solid waste and drainage). We study how existing laws manage human waste along the sanitation value chain. We also look for the inclusion or exclusion of several additional factors in the law including: vulnerable communities and informal settlements, gender, financing and the user-pay principle, citizen engagement, monitoring and reporting, water quality, rural v. urban, emergencies, data-sharing, institutions, and enforcement. Our preliminary research demonstrates that: (1) countries' sanitation policies are often limited in breadth and depth, providing limited clarity on what is required and by whom (e.gnon-sewered sanitation construction standards, effluent standards, water quality standards) (2) NSS is often not identified as an option, meaning that low-income communities and informal settlements are not being retrofitted with sanitation services, (3) the roles and responsibilities of responsible institutions are unclear and confusing, and (4) the mandate for making sanitation available to all citizens is weak, unfunded, or set forth with little information on how to actualize the right.

Conclusions and recommendation

Our research illustrates the need for stronger, more comprehensive legal frameworks governing sanitation paired with tools and resources that aid in implementation, enforcement, and periodic review as well as clearly defined institutions. Our conclusions will include a detailed comparison of approaches in the five countries as well as identify shortcomings, gaps, inconsistencies and strengths. Recommendation will highlight the types of provisions which should be included in any sanitation framework so as to best promote ecosystem health and community.

The Canadian Experience: Enhancing Urban Stream Habitat and Building Resilience

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Keywords

Enhancement, natural capital, Canada, urban streams, bioengineering

Highlights

Valuing nature and natural capital is a growing trend in Canada. Urban streams and the ecosystem services they provide have increasingly been acknowledged across many urban areas in Canada. Members of the Canadian Water Resources Association (CWRA) are at the forefront of stream restoration in Canada.

Introduction and objectives

Canada's experience with urban stream restoration projects, which has involved many members of the Canadian Water Resources Association (CWRA) have enabled communities to enhance natural capital and ecosystem services in an innovative manner to increase ecosystem benefits to society. The objective of this work is to highlight innovations and advances and the prevalence of stream enhancement techniques such as bioengineering and green shores projects across Canada. This presentation will highlight advances in stream and riverbank restoration techniques in Canada and show how enhancement projects can build flood and habitat resilience, offset carbon and increase natural capital and build social awareness.

Methodology approach

The power of CWRA is the network of water resources professionals across Canada. An established network of urban watercourse design professionals across Canada provides examples of stream restoration techniques and success rates from Canada's abundance of streams and urban watercourses. This identifies gains in habitat resulting from restoration projects and the degree of effectiveness of restoration techniques used to improve natural capital.

Analysis and results

Follow up monitoring of restoration projects including compilation of data is vital to understanding project effectiveness. A strong example to be highlighted is the City of Calgary's Riparian Monitoring Program and their Bioengineering Demonstration Project. Projects are beginning to be be assessed to evaluate the effectiveness of the techniques and determine the net benefits in the urban environment. Techniques can be grouped into categories based on the method of construction and nature and degree of ecosystem degradation. The benefits realized include CO_2 uptake and storage, improved air quality, flood and erosion damage reduction, improved recreation and aesthetics and improved water quality. Other benefits include community education, improved hydraulics, reduction is stream temperature, improvements in ecology.

Conclusions and recommendation

Urban stream restoration can provide a multitude of benefits to a community from basic increases in natural capital, net habitat gain and social understanding of the hydrological cycle. This examination of the effectiveness of urban stream restoration techniques has shown that further investment in restoration will enhance natural capital within the community, increase resilience to flooding and improve the social environment in a community. This knowledge can be used to drive further increase in restoration of urban watercourses and ecosystems.

The ecosystem in Gaza Strip between challenges and solutions. Palestine

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Highlights
Gaza Strip faces big challenges to secure ecosystem. This study focuses on Wadi Gaza and Gaza Beach. Wadi Gaza Nature Reserve is the main natural feature of the Gaza Strip. This study evaluates the ecosystem in Gaza and put the long-term investments and priorities.

Introduction and objectives
Gaza Strip has high growth rate percentage (3,44%). urbanization area increasing rapidly due high demands on lands. There is severe change in ecosystem in the whole Gaza Strip due to limited water resources, water salinity and using pesticides. These factors have severe impact on ecosystem. The main objectives of study is to evaluation the ecosystem in wadi Gaza and Gaza Beach and to put the long term solutions to secure ecosystem.

Methodology approach
This study focusses on two zones in Gaza Strip; Wadi Gaza and Gaza Beach. Data collection have been achieved and spatial maps have been developed using data from local authorities in addition of study samples. 100 samples have been measured from different categories and compared it with last 10 years. Scenario in 2030 is predicted.

Analysis and results
More than 150 terrestrial species are in Wadi Gaza affected by climatic changes. There is diversity of flora with 70 species including crop wild-relatives, barley, parsley, Salvia sp, peppermint and sweet basil. Ecosystem and biodiversity is suffering and high changed and loss of habitat due to urban development, pollution, increasing of water salinity and using of pesticides. About 50 % of Gaza's beaches are polluted due pumping untreated sewage into the sea because of Electricity Shortages which is very dangerous to health and safety.

Conclusions and recommendation
This study adapted solutions to secure the ecosystem in Gaza Strip and helps decision makers to put the investments to conserve the ecosystem as followings; increasing the efficiency of Gaza Power Plant and using of renewable energy, improving economic profitability for farmers to keep farms from destroyed. Removing illegal wells to remain the water level reducing the salinity, recharge storm water into ground, improve wastewater networks for surround area of wadi Gaza to avoid reaching of sewage to wadi Gaza. Increasing awareness application of land-use policies. crop production systems management including soil and water resources, Greenhouse management. Considering Wadi Gaza as protected area and controlled by authority.